

## A SYSTEM AND METHOD FOR PERFORMING THROTTLE CONTROL IN A SMPP GATEWAY

### CROSS-REFERENCE TO RELATED APPLICATIONS

- Sub  
ai
- 09714033-11700
- The present application is related to U.S. Application No., \_\_\_\_\_, entitled "A  
5 SMPP GATEWAY HAVING A STANDARD INTERFACE" (Attorney Docket 2000-  
0474 (AWS527)), Application No. \_\_\_\_\_, entitled "A METHOD OF  
DELIVERING SHORT MESSAGES USING A SMPP GATEWAY WITH  
STANDARD INTERFACE" (Attorney Docket 2000-0474A (AWS527A)), Application  
No. \_\_\_\_\_, entitled "A METHOD OF BINDING TO A SMPP GATEWAY"  
10 (Attorney Docket 2000-0474B (AWS527B)), Application No. \_\_\_\_\_, entitled "A  
SYSTEM AND METHOD FOR PERFORMING ANTI-SPAM CONTROL USING  
A SMPP GATEWAY" (Attorney Docket 2000-0474C (AWS527C)), and Application  
No. \_\_\_\_\_, entitled "A SYSTEM AND METHOD FOR PERFORMING FLOW  
CONTROL IN A SMPP GATEWAY" (Attorney Docket 2000-0474E (AWS527E)).  
15 Each of these applications is concurrently filed and commonly owned. The contents of  
each of these applications are incorporated herein by reference.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

- 20 The present invention relates to a gateway for delivering messages from a  
message source to wireless devices and, more specifically, to a short message point-to-  
point protocol gateway that performs a throttle control function associated with routing  
messages from an external source to a wireless device.

## 2. Discussion of Related Art

Wireless devices such as mobile telephones and the like can transmit and receive short messages from a variety of different sources. One example of a source of a short message destined for a wireless device is a short message entity (SME). Examples of such short message entities include computers, interactive voice response systems (IVR), teleservice servers, and intelligent peripherals. Examples of short messages that may be sent include voice mail and email. A device operating as a message source external to a wireless network is commonly called an external short message entity (ESME).

Typically, and in the context of this disclosure, an ESME is a device associated with a wired network that operates as a message source delivering a message to a mobile device. ESME messages destined for mobile devices are called herein mobile terminated (MT) messages since they originate from a wired ESME device and terminate with a mobile device. The following discussion relates primarily to MT messages.

In addition to operating as the source for a short message, ESMEs may also receive short messages from other devices, such as mobile devices. In this regard, messages originating from mobile devices are referred to herein as mobile originating (MO) messages.

A basic protocol for delivering messages from a wired network using a teleservice server to a wireless or mobile device is called the short message peer-to-peer (or point-to-point) protocol (SMPP). In addition to this basic protocol that may be used for a variety of ESMEs, the exact message flows from the ESME to the mobile device varies for each teleservice provider. A basic network architecture by which a message is delivered from a message source to a message-receiving device is shown in FIG. 1. As discussed below, numerous logical interfaces are presently necessary between an ESME and a wireless network in order to send and receive short messages. The different logical interfaces are

necessary because numerous teleservices associated with ESMEs require different protocols for interfacing their ESME with routers in order to deliver the messages.

The architecture shown in FIG. 1 illustrates a system for delivering short messages from an ESME to a wireless network device. An external short messaging entity 108, 110, 112, 114 or 102 is the source of a short message. Examples of an ESME may include the telephone, cellular phone, computer connecting through the Internet 106 to a network, or the like. A plurality of messaging (or message) centers 124<sub>1</sub> – 124<sub>x</sub> (MCs) each receives messages from one of the ESMEs. Since there are many different protocols for communicating short messages to the messaging centers, each messaging center can only receive messages sent by ESMEs 102 delivering messages according to a known protocol for that messaging center. If the destination of the ESME 102 message is a wireless device, the MCs 124<sub>1</sub> – 124<sub>x</sub> transmit the short messages to a wireless network having network nodes and network switching centers 128, 130. The wireless network includes a home location register 126, a mobile switching center 132 and antennas in order to deliver the message using the over-the-air interface. The mobile receiving device, or wireless device 136, receives and displays the intended message to a user.

As the demand for messaging services increases, the number of messages delivered by message centers will also increase. The increased demand poses difficulties in scaling the message complex to handle numerous ESME requests. Furthermore, non-standard ESMEs or ESMEs that do not recognize a messaging protocol for a phone number or pager number may be the intended destinations or message sources for a message. This increases the complexity of the network requirements for delivering messages.

Having discussed MT messaging, we now turn to a discussion of messages that originate from a mobile device. These are referred to herein as mobile originated (MO)

messages. Delivering MO messages, like MT messages, suffers from the problem discussed above wherein numerous interfaces are necessary for the variety of protocols used for the numerous teleservices. MO messages are transmitted from the mobile device through the wireless network to an MC 124<sub>1</sub> – 124<sub>x</sub>. However, each mobile device transmits messages to its associated MC 124<sub>1</sub> – 124<sub>x</sub>, wherein routing tables or a translation process are needed to route the message in the direction of the destination ESME. Many different messaging interfaces are necessary for transmitting the message from the MC 124<sub>1</sub> – 124<sub>x</sub> to an ESME 102. The translation processes and need for knowledge of a variety of message types slows down the transmission of the message and the ultimate message delivery time.

Currently, throttle control is rarely performed for SMPP messages, although the SMPP standard protocol provides for the throttle function but describes no implementation. The throttle control presently used, if any, is based on the total message flow. The present throttle control monitors the sum of all messages arriving at the MC from all ESMEs and determines if that sum exceeds a predetermined limit. When the throttle control limit is reached, a throttle control message is transmitted to all the ESME's to reduce the messages sent.

There are deficiencies in the present method of performing throttle control. For example, it is unfairly governed. If a single ESME transmits so many messages that throttle control is necessary, other ESMEs bound to the system will receive a throttle error signal preventing them from transmitting messages where the neighboring ESME is the one clogging the system. This unnecessarily inhibits messages from being sent by ESMEs who are not transmitting messages.

## SUMMARY OF THE INVENTION

What is needed in the art is a single logical interface to the messaging complex with a fair and efficient throttle control. The single logical interface to the messaging complex according to the present invention is called a short messaging point-to-point (SMPP) gateway (SG) and will provide one consistent interface for ESMEs to request delivery of service. ESMEs will also be isolated from any knowledge of the underlying messaging complex or wireless network implementation. With this implementation of a standard interface, non-standard ESME's may be allowed to connect to a messaging complex and transmit short messages.

In addition, what is needed in the art is a fair and equitable throttle control system. With the introduction of the SG, throttle control is applied on a per ESME basis. A maximum message rate is established for each ESME and enforced by the SG. Thus the present invention addresses the unfairness of the previous throttling methods by transmitting throttle error messages on a per ESME basis, not on an aggregate message flow basis. The message flow from each ESME can be controlled with this approach. This in effect allocates capacity to each ESME.

Prior to summarizing throttle control according to the present invention, we turn to an introduction to the SG and supporting technology surrounding the invention.

The SG of the present disclosure provides a single logical interface for all SMPP messages going to and from the messaging complex and eliminates the need for ESMEs to have any implementation knowledge of the messaging complex or wireless network. The SG provides routing from an ESME to the destination MC based on service being delivered and provides MC reconfiguration capability that does not require reconfiguration of ESMEs. The SG also provides efficient scaling in the SG as traffic increases and achieves minimal delay in message delivery. The SG routing system

minimizes or eliminates the modification of any parameters in SMPP messages and is configurable to support all SMPP message types.

In order to achieve the advantages of the present invention, the following system is used. The disclosed system enables an ESME to submit messages for delivery to a wireless device. One aspect of the disclosure relates to mobile terminated (MT) messages. The system involves implementing an external interface to the messaging complex and enables all ESMEs to communicate with the messaging complex using a consistent standard interface.

According to this disclosure, a system for allowing an external short message entity to submit a message to be delivered to a message-receiving device in a wireless network comprises an SG communicating with a plurality of messaging centers and communicating with a plurality of ESMEs. The ESME connects or "binds" to the SG and requests delivery of a message to a wireless device. The SG routes the request to an appropriate messaging center. The SG is configured such that any external short messaging entity only needs to have knowledge of a single protocol for requesting delivery of messages from the SG.

The ESME also connects to the SG by submitting a bind request signal including a system identification, password and system type. The SG responds to the bind request with a bind response signal including a system identifier and an error message if a bind is not successful. If a bind is not successful, the bind response signal includes an error signal indicating why the bind was not successful.

An important feature of the disclosure is that the SG determines the routing method based on a service type. The SG communicates with a plurality of messaging centers and determines the routing method to a destination message center according to the service type. The routing method may one chosen from a group comprising:

message center specific, load balancing, MDN range, equal allocation, and ESN. Other routing methods may also be added.

The method disclosed herein enables an ESME to submit messages to be delivered to a wireless device. The method comprises requesting delivery of a service to a wireless device from an SG, routing the request to a message center according to a service type and a routing method, and delivering the request to a wireless network.

Another aspect of this disclosure comprises a system for transmitting short messages from a mobile station to an ESME. These are mobile originated (MO) messages. This aspect of the disclosure comprises a system for allowing a message source to submit a message to be delivered to a message-receiving device. The system comprises a short messaging point-to-point gateway communicating with a plurality of messaging centers. The messaging centers communicate with a wireless network associated with the message-originating source. The message source transmits the message to one the plurality of messaging centers, and the one of the plurality of messaging centers requests from the SG delivery of a message to the message-receiving device. The SG routes the request to the messaging receiving device. The SG determines a routing method based on a service type. The short messaging point-to-point gateway is configured to inquire whether anti-spamming is enabled according to a service type.

According to the disclosure related to MO messages, the message source connects to the one of the plurality of messaging centers by submitting a short message containing teleservice ID (TID), bearer data, source address and destination address. One of the plurality of messaging centers transmits a delivery short message signal to the SG. The SG determines a routing method based on a service type. The service types available from which to choose include, but are not limited to: ESME specific, load balancing, equal allocation, destination IP address, and destination address.

Having introduced some of the elements and functionality surrounding the throttle control concept of the present invention, we now turn more specifically to throttle control. The SG according to the present invention also performs throttle control. Throttle control relates to controlling the number of messages sent by ESMEs either individually or as group. Throttle control according to a method of the present invention comprises controlling the delivery of a message sent from each individual ESME to a message-receiving device through the SG. Rather than performing throttle control in the aggregate as previously done, throttle control is performed on an ESME-by-ESME basis. The method comprises transmitting a data unit associated with the message from the message source to the gateway, determining whether the message source has exceeded a threshold value associated with sending messages, and transmitting a response signal from the gateway to the message source indicating an error if the message source has exceeded the threshold value.

In this manner, throttle control can be performed fairly and equitably in the system and only prevent ESME's from continuing to send messages that have exceeded the predetermined message delivery limit.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

The various embodiments of the invention may be understood with reference to the attached drawings, of which:

FIG. 1 shows a diagram illustrating the prior art architecture for delivering short messages through a messaging complex;

FIG. 2 illustrates the architecture of the system according to the first embodiment of the present invention;

FIG. 3 shows the process of an ESME binding to the SG;

FIG. 4 shows the process of the SG binding to MCs;



FIG. 5 illustrates an example of a mobile-terminated message flow;

FIG. 6 shows exemplary routing of a message based on the service type;

FIG. 7 illustrates another example of a mobile-terminated message delivery flow;

FIG. 8 shows flow control between an ESME and the SG;

5        FIG. 9 shows a message delivery with anti-spam check process for mobile-  
originated messages;

FIG. 10 shows a flow diagram for anti-spam logic for both mobile-originated and  
mobile-terminated messages;

FIG. 11 shows a mobile-terminated message processing logic;

10       FIG. 12 shows a flow control message sequence for a scenario where the MC is  
congested and alternate MC's may or may not be available;

FIG. 13 illustrates a message flow for a mobile-originated message;

FIG. 14 illustrates exemplary message processing for a mobile-originated  
message;

15       FIG. 15 shows an exemplary message cancel process;

FIG. 16 shows a message replacement process;

FIG. 17 shows a check link status process;

FIG. 18 shows an alert notification process;

FIG. 19 illustrates an example of message flow for an activation process; and

20       FIG. 20 shows an example of the hardware associated with the SMPP gateway.

## **DETAILED DESCRIPTION OF THE INVENTION**

The first embodiment of the present invention comprises a system architecture  
for allowing external sources to connect using the short message point-to-point (SMPP)  
25    protocol and request delivery of short messages to wireless subscribers. In the context  
of this disclosure, an SMPP Router (SR) and SMPP Gateway (SG) may be considered the

same apparatus. An overview of the system may be understood with reference to FIG.

2. In this disclosure, since a messaging complex and message center both may be shortened to "MC", typically a message center will be shortened herein to "MC" to reduce any confusion. Message complexes are referred to using the full name.

5 As shown in FIG. 2, the system architecture 200 comprises at least one External Source of a Message Entity (ESME) 202. Each ESME is connected via a firewall 204 to a message complex 216, described in more detail below. Messages may also come from the Internet 206 via an ESME email hub 208. Other sources of ESMEs include an ESME Over-The-Air Activation Facility – OTAF 210, an ESME paging system such as  
10 the Teknow system 212 using Dual Tone Multi-Frequency (DTMF), Telocator Alphanumeric Paging Protocol (TAP), or TNPP protocols, or an ESME Voice Mail System (VMS) 214. The Teknow system 212 is a paging system that receives paging requests and forwards the request to the message center for delivery using the TNPP protocol. The Teknow interface may also use other protocols for delivery, such as SMPP  
15 or DTMF for tone encoding. The Comverse system 214 is a voice mail system that forwards voice mail waiting notifications to a gateway. Examples of the kinds of messages that may be sent from an ESME include weather reports, stock quotes and the like. The overall system according to the present invention may also be called an "SMPP Receivership."

20 The SMPP Receivership 200 relies on implementing an external interface to the messaging complex 216. The messaging complex 216 comprises a plurality of messaging centers 224<sub>1</sub> – 224<sub>x</sub>. The subscripts "1" through "x" with respect to the messaging centers indicates that there may be only one messaging center in the message complex 216 or as many as "x" messaging centers in the message complex 216. The interface  
25 uses SMPP over TCP/IP and allows all ESMEs 202 to communicate with the messaging

complex 216 using a consistent standard interface. To accomplish this task, a SMPP Gateway (SG) 222 is introduced into the messaging complex 216 architecture. The ESMEs 202 know only about the SG 222 and have no knowledge of the underlying implementation of the messaging complex 216 or wireless network. Requiring ESMEs 202 to know only about the SG 222 eliminates the need for the message complex 216 to maintain knowledge of the underlying implementation or characteristics of the ESMEs 202.

The SG 222 receives a message delivery request and routes the message, based on service type and routing methods, to the appropriate message center MC 224<sub>1</sub>-224<sub>x</sub> for delivery to a wireless subscriber 236 in the wireless network. The wireless network includes a home location register 226, mobile switching center 232, base stations 234, and other standard wireless nodes 228 and 230. These nodes 228, 230 may be, for example, a mobile switching center, home location register, a mobile station and the like. The SMPP Receiver 200 does not communicate directly with these nodes.

One kind of message that may be transmitted through the SMPP Receiver 200 is a mobile terminated (MT) message. An MT message originates at an ESME 202 and is meant to be delivered to a wireless service subscriber or a wireless device 236. To achieve deliverance of a MT message, an ESME 202 connects to the SG 222 and requests delivery of a specific service to a specific wireless device or mobile station 236. The SG 222 routes the request to the appropriate MC 224<sub>1</sub>-224<sub>x</sub> for subsequent delivery in the wireless network. The SG 222 maintains service to MC 224<sub>1</sub>-224<sub>x</sub> relationships and routing rules. Responses from the MC 224<sub>1</sub>-224<sub>x</sub> are sent to the SG 222 and subsequently to the ESME 202.

Another type of message that may be transmitted on the system 200 includes a mobile originated (MO) message or service. This type of message originates with a

mobile device 236 to be delivered to an ESME 202. For MO services, the SG 222 routes the message received from the MC 224<sub>1</sub>-224<sub>x</sub> to an ESME 202. The SG 222 maintains service to ESME 202 relationships and routing rules. Responses from the ESME 202 are sent to the SG 222 and subsequently to the MC 224<sub>1</sub>-224<sub>x</sub>.

5 In addition to routing messages, spam control is desirable in the SMPP Receiver 200. The network element D2 220 is an enhanced version of a Detection of Undesirable E-mail (DUE) processor 218 that the SG 222 queries for spam control. The D2 220 may be a separate server or a module running on the DUE 218 or on the SG 222. The D2 220 is an enhanced spam control server or processor separate from the undesirable  
10 message detection server (DUE) 218. If the D2 220 is implemented as a separate server, then the functionality described herein is implemented according to hardware elements common to servers, such as a processor, memory, interface controls, etc. These elements are known to those of skill in the art and do not need to be further discussed herein.

15 According to the present invention, the standard DUE capability, for example from a DUE server 218, is enhanced to support queries from the SG 222. For MT messages, spam is defined as the number of MT delivery requests for a specific subscriber 236 exceeding a predefined number within a specific time interval. For example, spam for a particular service type may be defined as 20 delivery requests within  
20 three minutes. For MO messages, spam is defined as the number of MO delivery requests from a specific subscriber 236 exceeding a predefined number within a specific interval. The following list provides some of the major functions of the D2 220:

1. The D2 220 receives a query from the SG 222 containing the service type, source address and destination address;
- 25 2. For MT service, the D2 220 updates its message delivery request counters for the mobile destination number (MDN) contained in the destination address parameter. If the number of delivery requests have been exceeded for the

time interval, then D2 220 returns a status of 'deny'. Otherwise, the D2 220 returns a status of 'allow';

3. For MO service, the D2 220 updates its message delivery request counters for the MDN contained in the source address parameter. If the number of delivery requests have been exceeded for the time interval, then the D2 220 returns a status of 'deny'. Otherwise, the D2 220 returns a status of 'allow'; and
4. The D2 220 maintains a list of denied MDNs. If the MDN is on the denied list, the D2 220 returns a status of 'deny'.

According to the preferred mode of the first embodiment of the present invention, the following assumptions are made: Numerous ESMEs 202 will attach to the Messaging Complex 216; the ESMEs 202 may be wireless or non-wireless; the Messaging Complex 216 will consist of a number of physical MC platforms; the interface between ESMEs 202, MCs 224<sub>1</sub>-224<sub>x</sub>, and SG 222 will be SMPP over TCP/IP; for capacity and redundancy purposes, a teleservice may be delivered by more than one MC 224<sub>1</sub>-224<sub>x</sub>; one MC 224<sub>1</sub>-224<sub>x</sub> may deliver more than one teleservice; physical MC 224<sub>1</sub>-224<sub>x</sub> platforms may be supplied by more than one vendor; Teleservice applications may be supplied by more than one vendor; teleservices will be delivered in a number portability environment; services, except for activations, will be mobile directory number (MDN) based; ESMEs 202 will communicate with the SG 222 using dedicated network connections; traffic between the ESMEs 202 and SG 222 may or may not travel over the Internet depending on the security desired; and two over-the-air-activation processor (OTAP) nodes will be required for activations.

The SG 222 supports protocol data units (PDUs) defined by the SMPP v 3.4 specification and is backwards compatible to older versions. The SG 222 also supports vendor-specific error codes returned in a command\_status parameter. These error codes include, for example: "Service Type Not Available" (0x00000410); "ESME Not Authorized for Service Type" (0x00000411); "Service Denied" (0x00000412); "Invalid Service Type" (0x00000413); "ESME Prohibited" (0x00000414); "Congestion"

(0x00000400). These error code values are implemented using the block of error code values reserved for vendor-specific errors.

The SG 222 requires the introduction of the new SMPP error codes described in the following Table 1:

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Command Status Description	Conditions When Returned
Service type not available	<p>The SG determines that no MCs are available to deliver the requested service. This could occur when all MC that deliver a specific service type are unavailable.</p> <p>For MT messages this error is returned by SG to ESME in:</p> <ol style="list-style-type: none"> <li>1. Submit_SM_Resp</li> <li>2. Submit_Multi_Resp</li> <li>3. Data_SM_Resp</li> </ol> <p>For MO messages this error is returned by the SG to MC in:</p> <ol style="list-style-type: none"> <li>1. Deliver_SM_Resp</li> <li>2. Data_SM_Resp</li> </ol>
ESME not authorized for service type	<p>The SG determines that the ESME is not authorized to request delivery of the service_type specified in:</p> <ol style="list-style-type: none"> <li>1. Submit_SM</li> <li>2. Submit_Multi</li> <li>3. Data_SM</li> </ol> <p>For MT messages this error is returned by SG to ESME in:</p> <ol style="list-style-type: none"> <li>1. Submit_SM_Resp</li> <li>2. Submit_Multi_Resp</li> <li>3. Data_SM_Resp</li> </ol>
Service denied	<p>The SG determines that the message cannot be delivered because it failed anti-spam check.</p> <p>For MT messages this error is returned by SG to ESME in:</p> <ol style="list-style-type: none"> <li>1. Submit_SM_Resp</li> <li>2. Submit_Multi_Resp</li> <li>3. Data_SM_Resp</li> </ol> <p>For MO messages this error is returned by the SG to MC in:</p> <ol style="list-style-type: none"> <li>1. Deliver_SM_Resp</li> <li>2. Data_SM_Resp</li> </ol>

Command Status Description	Conditions When Returned
ESME Prohibited	The ESME has been placed in prohibited state by administrative action at the SG. ESME Prohibited is returned if an ESME attempts to bind to the SG if while it has a state of prohibited at the SG.
Congestion	The MC returns Congestion when its inbound message queue exceeds a specific threshold. The congestion command_status indicates that the ESME should invoke flow control.

Now we turn to a discussion of the binding process between ESMEs 202 and the SG 222. In order for an ESME 202 to request and deliver a message according to the present invention, the ESME 202 must "bind" to the SG 222. This process is illustrated in FIG. 3. The "bind" operation is comparable to logging into a computer system. The external system requests a session with the gateway by presenting an ID and a password. If the ID and password are successfully authenticated, a session is established between the gateway and the ESME 202. An ESME 202 binds to the SG 222 as a transmitter for mobile terminated (MT) services. A bind request (Bind\_Transmitter) includes the system\_id, a unique identifier for the ESME 202, password, and system\_type. System\_type identifies the type of service that the ESME 202 will deliver. The SG 222 verifies that the ESME 202 is authorized using system\_id, password, and system\_type. The MCs 224<sub>1</sub>-224<sub>x</sub> repond with a Bind\_Transmitter\_Resp signal including system\_id and MC signals. The system\_id identifies the SG 222. If a bind is not successful, the SG 222 returns the appropriate command\_status including Bind Failed, Invalid Password, and Invalid System ID.

An ESME 202 binds to the SG 222 as a receiver for mobile originating (MO) services using the Bind\_Receiver PDU. All other steps are the same as described in the Bind\_Transmitter signal above. In general, the response from a bind operation indicates

whether the bind attempt was successful or the response is an error code describing the error that prevented the connection.

An ESME 202 binds to the SG 222 and all defined MCs 224<sub>1</sub>-224<sub>x</sub> configured for MT and MO services as a transceiver/receiver for interactive services using the

5 Bind\_Transceiver PDU. All other steps are the same as described in the Bind\_Transmitter signal. At initialization, the SG 222 binds to all of the MCs 224<sub>1</sub>-224<sub>x</sub> that it is configured to know about.

The SG 222 enables the introduction of a different binding concept from previous concepts. For MT messages, an ESME 202 binds to the SG 222. The SG 222

10 binds and maintains binds to many MCs 224<sub>1</sub>-224<sub>x</sub>. The mapping of many binds from the SG 222 to MC 224<sub>1</sub>-224<sub>x</sub> for MT services and the mapping of many binds from the SG 222 to many ESMEs 202 for MO services is a critical functionality for the SG 222.

For MT services, the SG 222 maintains binds to many MCs 224<sub>1</sub>-224<sub>x</sub> while maintaining a single bind to the ESME 202. The ESME 202 does not need to know how

15 or to which MC 224<sub>1</sub>-224<sub>x</sub> to bind. The same concept applies in reverse to MO Messages. The SG 222 maintains binds to many ESMEs 202 while maintaining a single bind to the MC 224<sub>1</sub>-224<sub>x</sub>. The MC 224<sub>1</sub>-224<sub>x</sub> does not need to know how or to which ESME 202 to bind. The many binds from the SG 222 to the MCs 224<sub>1</sub>-224<sub>x</sub> are

20 mapped for MT services and the many binds from the SG 222 to many ESMEs 202 are mapped for MO services. The communication between the ESME – SG – and MC is accomplished using TCP/IP for transport. The TCP/IP protocol transports the SMPP protocol messages.

The process of the SG 222 binding to the MCs 224<sub>1</sub>-224<sub>x</sub> is illustrated in FIG. 4. As shown in FIG. 4, the SG 222 maintains the availability status of each of the MCs

25 224<sub>1</sub>-224<sub>x</sub> and attempts to rebind in case a bind is lost or fails. As discussed above, there



are different binding methods for respective services available: MT service, MO service and MT and MO service.

The SG 222 populates the Bind\_Transmitter, Bind\_Receiver, and Bind\_Transceiver PDUs according to the bind parameters configured for the MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 updates its internal routing tables to indicate the status of each MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 also maintains an association between services and available MCs 224<sub>1</sub>-224<sub>x</sub>. In this scenario, the SG 222 maintains a static reference between services and each MC 224<sub>1</sub>-224<sub>x</sub>. In the preferred mode of the first embodiment of the invention, the SG 222 queries the MCs 224<sub>1</sub>-224<sub>x</sub> to determine the services each MC 224<sub>1</sub>-224<sub>x</sub> delivers and their status. The SG 222 then preferably binds to the MC 224<sub>1</sub>-224<sub>x</sub>. In another aspect of the invention, the SG 222 may bind to a service type, rather than to an MC 224<sub>1</sub>-224<sub>x</sub>.

The binding process includes protocols for handling failed binding scenarios. For example, if a bind attempt between the SG 222 and an MC 224<sub>1</sub>-224<sub>x</sub> fails, the SG 222 may issue an alarm. The bind fail alarm, if provided, contains, at a minimum, MC system\_id, time, and bind failure reason. Additional information may be provided.

If an established bind between the SG 222 and an MC 224<sub>1</sub>-224<sub>x</sub> fails, the SG 222 issues an alarm. The bind lost alarm shall contain, at a minimum, MC system\_id, time, and bind loss reason if known. Additional information may also be provided.

If a bind attempt between the SG 222 and MC 224<sub>1</sub>-224<sub>x</sub> fails, the SG 222 periodically attempts to establish the bind. If a bind between the SG 222 and a MC 224<sub>1</sub>-224<sub>x</sub> is lost, the SG 222 periodically attempts to reestablish the bind. The SG 222 maintains a configurable bind retry interval. The bind retry interval applies to failed and lost binds. In the preferred embodiment, the bind retry interval has a resolution of 1 minute and a default value of 5 minutes. However, other values may be used as retry intervals or default values.

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All bind attempts to MCs 224<sub>1</sub>-224<sub>x</sub>, successful or unsuccessful, are logged in the event log. The minimum information provided includes time, MC system\_id, system type, and bind status. If bind status returns as “unsuccessful,” the failure reason is provided, along with other information if desired. Bind parameters for each MC 224<sub>1</sub>-  
5 224<sub>x</sub> are configured at the SG 222. A further discussion of the details of bind parameter provisioning is provided below.

It is necessary for the SG 222 to support ESMEs 202 and MCs 224<sub>1</sub>-224<sub>x</sub> operating at different SMPP interface version levels. For mobile terminated (MT) service, the level of service available in the wireless network is determined by the  
10 interface version available at the MC 224<sub>1</sub>-224<sub>x</sub>. An ESME 202 should not be able to request services using an interface version that is not yet supported by the MC 224<sub>1</sub>-224<sub>x</sub>. If an ESME 202 binds to the SG 222 and requests message delivery at the SMPP interface version that is greater than the version supported at the destination MC 224<sub>1</sub>-224<sub>x</sub>, the message is rejected at the SG 222. Basic backward compatibility rules apply.  
15 The SG 222 routes messages to the selected MC 224<sub>1</sub>-224<sub>x</sub> only when the SMPP interface version of the selected MC 224<sub>1</sub>-224<sub>x</sub> is equal to or greater than the SMPP interface version of the originating ESME 202. The SG 222 rejects messages routed to the selected MC 224<sub>1</sub>-224<sub>x</sub> when the SMPP interface version of the selected MC 224<sub>1</sub>-224<sub>x</sub> is less than the SMPP interface version of the originating ESME 202. The SG 222  
20 then returns a System Error (0x00000008) error code to the originating ESME 202.

For mobile originated message service, if an MC 224<sub>1</sub>-224<sub>x</sub> requests message delivery at an SMPP interface version that is greater than the version supported at the destination ESME 202, the message is rejected at the SG 222. Basic backward compatibility rules apply. The SG 222 routes messages to the selected ESME 202 only  
25 when the SMPP interface version of the selected ESME 202 is equal to or greater than

the SMPP interface version of the originating MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 rejects messages routed to the selected ESME 202 when the SMPP interface version of the selected ESME 202 is less than the SMPP interface version of the originating MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 in this case returns a System Error (0x00000008) error code to the  
5 originating MC 224<sub>1</sub>-224<sub>x</sub>.

The message flow for a mobile terminated (MT) message is illustrated in FIG. 5. In the MT mode, the ESME 202 sends a Submit\_SM signal to SG 222. The service\_type parameter identifies the service to be delivered. The SG 222 invokes a routing method based on service\_type and routing method dependent parameters to select destination  
10 MC 224<sub>1</sub>-224<sub>x</sub>. The MT routing methods apply for ESME 202 to MC 224<sub>1</sub>-224<sub>x</sub> communication and include such methods as MC specific, load balancing, MDN range, equal allocation and ESN. These will be discussed in more detail below. Using the appropriate routing method, a primary destination MC 224<sub>1</sub>-224<sub>x</sub> is first selected. If the primary destination MC 224<sub>1</sub>-224<sub>x</sub> is not available, a secondary MC 224<sub>1</sub>-224<sub>x</sub> is selected.

FIG. 6 illustrates the routing based on service\_type. Each service type 452 has an associated routing method 454. The SG 222 determines a primary 456 or secondary 458 destination using the routing method, routing data 460, and parameters in the SMPP message. Service types are defined independently of the teleservice used to deliver the service. This approach allows service types to be created that are not identified by the  
15 underlying teleservice.  
20

An ESME 202 requests delivery of a message for a specific service type. The SG 222 routes the message to the MC 224<sub>1</sub>-224<sub>x</sub> that delivers that service type. The MC 224<sub>1</sub>-224<sub>x</sub> uses a specific teleservice type to deliver the message. With this approach new service types, from an ESME perspective, can be introduced without the introduction of  
25 new teleservices. Additional service types are configurable in the SG 222. Service types

do not have to be teleservice-specific as long as there is end-to-end continuity of service definition. For example, different priority CMT messages could be assigned different service types in the SG 222 and routed to MCs 224<sub>1</sub>-224<sub>x</sub> dedicated to high or low priority messages.

- 5 For example, the following service types could be defined in Table 2:

ESME Service Type	Description
SMS	MT SMS
SMS – high priority	MT SMS given higher delivery priority
SMS – MO	MO SMS to e-mail address destination
Information services	Push information services. Potentially many variations of this service type.
Telematics	MT and MO telematics services. Potentially many variations of this service type.
WAP	Interactive services using WAP
OAA	Activations
OAP	Reprogramming

- The routing methods described herein require that the message\_id parameter uniquely identify the message and the MC 224<sub>1</sub>-224<sub>x</sub> that delivered the message. The message\_id parameter is intended to uniquely identify each message sent between the
- 10 ESME 202 and an MC 224<sub>1</sub>-224<sub>x</sub>. When a number of MCs 224<sub>1</sub>-224<sub>x</sub> are used to deliver messages, it cannot be guaranteed that the message\_id returned by a MC 224<sub>1</sub>-224<sub>x</sub> will be unique across all MCs 224<sub>1</sub>-224<sub>x</sub>. To eliminate this ambiguity, each message passing through the gateway requires a unique message\_id. The message\_id must uniquely identify the message and the MC 224<sub>1</sub>-224<sub>x</sub> that delivered it. A unique message\_id
- 15 parameter that identifies both a message and message center is required to support Query\_SM, Cancel\_SM, and Replace\_SM operations.

To support these operations it is necessary for the SG 222 to return a unique message\_id to the ESME 202 with each message submitted. The ESME 202 then can use the message\_id in these operations to uniquely identify the subject message. Several

options are possible for providing a unique message\_id. In the preferred embodiment of the invention, option 1 below is chosen. These are:

1. Configure each MC 224<sub>1</sub>-224<sub>x</sub> so that it uses a specific range for the message\_id. This will uniquely identify each message and the message center that delivered it. The message\_id is recycled within its defined range on each MC 224<sub>1</sub>-224<sub>x</sub>. Up to 65 octets are allowed for message\_id.
2. Have the SG 222 assign a unique message\_id to Submit\_SM\_Resp, Submit\_Multi\_Resp, Data\_SM\_Resp, and Deliver\_SM\_Resp. This could be accomplished by prepending a message center key to the message\_id returned to from the MC 224<sub>1</sub>-224<sub>x</sub>. For example, a new message\_id = MC\_key + MC message\_id.

The routing methods introduced above establish the rules used to route messages to a destination. Different routing rules are used for MT and MO messages. MT routing methods apply to ESME 202 to MC 224<sub>1</sub>-224<sub>x</sub> routing. A MT service type can have one of the following routing methods shown in Table 3:

MC Specific	Route all messages for this service type to a specific MC.
Load Balancing	Route messages to a group of MCs based on load capabilities of each MC in the group. Each MC in the group is allocated messages based on its capacity.
MDN Range	Route to a specific MC based on the MDN range of the destination address. The objective of this routing method is to provide deterministic routing for a group of MCs delivering a service that require Replace if Present (RIP). For RIP to be effective messages for the same destination must be routed to the same MC for delivery.
Equal Allocation	Route messages to a group of MCs based on sequentially sending messages to each MC in the group. Each MC in the group gets an equal number of messages.
ESN	For OATS use ESN to route to the destination MC.

The following Table 4 describes the SMPP PDUs and parameters used for each MT routing method.

Routing Method	SMPP PDUs	SMPP Parameters Used for Routing	RIP Supported	Query Supported
MC Specific	Submit_SM Data_SM Submit_Multi	-service_type	Yes	Yes
Load Balancing	Submit_SM Data_SM Submit_Multi	-service_type	No	Yes
MDN Range	Submit_SM Data_SM Submit_Multi	-service_type -destination_addr	Yes	Yes
Equal Allocation	Submit_SM Data_SM Submit_Multi	-service_type	No	Yes
ESN	Submit_SM	-service_type -short_message	Yes	Yes

- We first discuss the MC Specific routing method. The SG 222 routes all Submit\_SM, Data\_SM, or Submit\_Multi PDUs with the same service\_type to the same
- 5 MC 224<sub>1</sub>-224<sub>x</sub>. The MC Specific routing method allows a primary and alternate destination MC to be defined, although definition of an alternate MC 224<sub>1</sub>-224<sub>x</sub> is not mandatory. The MC Specific routing method routes the MT message to the primary destination MC 224<sub>1</sub>-224<sub>x</sub> if the primary MC 224<sub>1</sub>-224<sub>x</sub> is available. If the primary destination MC 224<sub>1</sub>-224<sub>x</sub> is not available, the MC Specific routing method routes the
- 10 MT message to the alternate destination MC 224<sub>1</sub>-224<sub>x</sub>.

- If both primary and alternate MCs 224<sub>1</sub>-224<sub>x</sub> are unavailable, the MC specific routing method responds to the ESME 202 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi-Resp PDUs if the SG 222 cannot route a message to an MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to
- 15 deliver the service\_type are unavailable.

The Load Balancing routing method routes messages to a group of MCs 224<sub>1</sub>-224<sub>x</sub> based on load capabilities of each MC 224<sub>1</sub>-224<sub>x</sub> in the group. Each MC 224<sub>1</sub>-224<sub>x</sub>

in the group is allocated messages based on its capacity. For example, Table 5 illustrates the proportioning of messages:

MC in Group	Proportion of Messages Allocated
MC – 1	25%
MC – 2	50%
MC – 3	25%
Total	100%

The SG 222 provides a Load Balancing routing method for MT messages. The Load Balancing routing method routes Submit\_SM, Data\_SM, or Submit\_Multi PDUs with the same service\_type to one of a group of MCs 224<sub>1</sub>-224<sub>x</sub> based on the message allocation established for each MC 224<sub>1</sub>-224<sub>x</sub>. The Load Balancing routing method allows a group of MCs 224<sub>1</sub>-224<sub>x</sub> delivering the same service\_type to be defined. The group contains two or more MCs 224<sub>1</sub>-224<sub>x</sub>. This routing method also allows the proportion of messages allocated to each MC 224<sub>1</sub>-224<sub>x</sub> in the group to be defined. The proportion is defined as a percentage of messages allocated to each MC 224<sub>1</sub>-224<sub>x</sub>.

The Load Balancing routing method routes messages to each of the MCs 224<sub>1</sub>-224<sub>x</sub> in the load balancing group based on proportion of messages allocated to each MC 224<sub>1</sub>-224<sub>x</sub>. Using the example above, if 100 messages are routed for a service type in some time interval, MC-1 will receive 25 messages, MC-2 will receive 50 messages and MC-3 will receive 25 messages. If an MC 224<sub>1</sub>-224<sub>x</sub> in a Load Balancing routing method group becomes unavailable, the messages destined for the unavailable MC 224<sub>1</sub>-224<sub>x</sub> are routed to the remaining MCs 224<sub>1</sub>-224<sub>x</sub>. The messages are allocated to the remaining available MCs 224<sub>1</sub>-224<sub>x</sub> based on the remaining MCs 224<sub>1</sub>-224<sub>x</sub> allocation of total capacity. The allocation added to each remaining MC 224<sub>1</sub>-224<sub>x</sub> equals the allocation

lost / number remaining MCs 224<sub>1</sub>-224<sub>x</sub>. Using the example above, suppose MC-3 becomes unavailable. Allocation added to each remaining MC = allocation lost / number of remaining MCs. Allocation added to each of the remaining MCs = 25% / 2 (=12.5%). MC-1 is now allocated 37.5% of the total (25% + 12.5% from MC-3). MC-2 is allocated 62.5% of the total (50% + 12.5% from MC-3).

If both primary and alternate MCs are unavailable, the Load Balancing routing method responds to the ESME 202 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi-Resp PDUs if the SG 222 cannot route a message to an MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to deliver the service\_type are unavailable.

The MDN range routing method routes messages to a specific MC 224<sub>1</sub>-224<sub>x</sub> based on the MDN range of the destination address. The objective of this routing method is to provide deterministic routing for a group of MCs 224<sub>1</sub>-224<sub>x</sub> delivering a service that requires guaranteed message delivery order or Replace If Present (RIP). For RIP to be effective, messages for the same destination must be routed to the same MC 224<sub>1</sub>-224<sub>x</sub> for delivery. The MDN range routing method has two possible configurations:

First, a complete range of MDNs is defined for the MDN routing group (from 000-000 through 999-999). This is illustrated in Table 6:

MDN Range Low	MDN Range High	Primary MC	Alternate MC
001-000	425-999	MC – 1	MC – 2
426-000	605-999	MC – 2	MC – 1
606-000	999-999	MC – 3	MC – 2

Second, an incomplete range of MDNs plus a Default MC is defined for the MDN routing group. Any destination\_address not within the defined MDN ranges is



routed to the Default MC. In this example any destination\_address that is not in the 001-000 to 605-999 range is routed to the Default MC. This is shown by way of example in Table 7:

MDN Range Low	MDN Range High	Primary MC	Alternate MC
001-000	425-999	MC – 1	MC – 2
426-000	605-999	MC – 2	MC – 1
Default	Default	MC – 3	MC – 4

5 The MDN Range routing method routes all Submit\_SM, Data\_SM, or Submit\_Multi PDUs with the same service\_type to one of a group of MCs 224<sub>1</sub>-224<sub>x</sub> based on the value of the MDN in the destination\_addr parameter. The MDN Range routing method allows a group of MCs 224<sub>1</sub>-224<sub>x</sub> delivering the same service\_type to be defined. The group contains two or more MCs 224<sub>1</sub>-224<sub>x</sub>.

10 The MDN range used by the MDN Routing method is defined by a low and a high MDN value with a resolution of NPA-NXX. The MDN Range routing method allows MDN ranges to be assigned to each MC 224<sub>1</sub>-224<sub>x</sub> in the group. It is possible to assign more than one MDN range to each MC 224<sub>1</sub>-224<sub>x</sub>. The MDN Range routing method does not allow overlapping MDN ranges to be defined for a specific  
15 service\_type.

The MDN Range routing method allows a Default MC to be defined. If the MDN received in the destination\_address parameter is not within the any of the MDN ranges defined for the group, the message is routed to the Default MC.

The SG 222 issues an alarm when a message is routed to the default MC 224<sub>1</sub>-  
20 224<sub>x</sub>. The minimum information provided includes the time, service type, source ESME, destination\_address of message routed to the default MC, and the default MC. Other

information may also be provided. The SG 222 logs all occurrences of messages routed to the default MC 224<sub>1</sub>-224<sub>x</sub>. The minimum information provided includes time, service type, source ESME, destination\_address of message routed to the default MC, and the default MC. Other information may be provided.

- 5 The MDN Range routing method for a specific service\_type does not become effective unless MDN range definition is complete and provides for routing of any MDN (from 000-000 through 999-999) or a Default MC is defined. The MDN Range routing method allows definition of an alternate MC 224<sub>1</sub>-224<sub>x</sub> for each MDN range.

- If the primary MC 224<sub>1</sub>-224<sub>x</sub> for the MDN range is not available and an alternate  
10 MC 224<sub>1</sub>-224<sub>x</sub> is defined and available, the MDN Range routing method routes messages to the alternate MC 224<sub>1</sub>-224<sub>x</sub>. If the primary MC 224<sub>1</sub>-224<sub>x</sub> for the MDN range is not available and an alternate MC 224<sub>1</sub>-224<sub>x</sub> is not defined or not available, the MDN Range routing method responds to the ESME 202 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi-Resp PDUs, if the  
15 SG 222 cannot route a message to an MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to deliver the service\_type are unavailable.

- The equal allocation routing method routes messages to a group of MCs 224<sub>1</sub>-224<sub>x</sub> based on sequentially sending messages to each MC 224<sub>1</sub>-224<sub>x</sub> in the group. Each MC 224<sub>1</sub>-224<sub>x</sub> in the group is sent an equal number of messages. The SG 222 provides  
20 an Equal Allocation routing method for MT messages. The Equal Allocation routing method routes all Submit\_SM, Data\_SM, or Submit\_Multi PDUs with the same service\_type to one of a group of MCs 224<sub>1</sub>-224<sub>x</sub> based on sequentially sending messages to each MC 224<sub>1</sub>-224<sub>x</sub> in the group. The Equal Allocation routing method allows a group of MCs 224<sub>1</sub>-224<sub>x</sub> delivering the same service\_type to be defined. The group shall  
25 contain two or more MCs 224<sub>1</sub>-224<sub>x</sub>.



4. The least significant seven digits are used as the NXX-XXX portion of the activation MIN. The least significant seven digits of the ESN are appended to the activation NPA, 000, resulting in an activation MIN of 0008056049.

5 The ESN routing method is used to route activation requests to two or more MCs 224<sub>1</sub>-224<sub>x</sub> delivering the OATS teleservice. If two OATS MCs 224<sub>1</sub>-224<sub>x</sub> are used, then routing is based on the odd – even value of the decimal ESN. One MC 224<sub>1</sub>-224<sub>x</sub> receives activation requests with even ESNs, one MC 224<sub>1</sub>-224<sub>x</sub> receives activation requests with odd ESNs. If more than two OATS MCs 224<sub>1</sub>-224<sub>x</sub> are used, then routing

10 is based on an ESN range assigned to each MC 224<sub>1</sub>-224<sub>x</sub> in the group. The ESN range is defined by the last two digits of the decimal ESN. This allows up to 100 MCs 224<sub>1</sub>-224<sub>x</sub> in a group. For example, Table 8 illustrates the ESN ranges:

MC in Group	ESN Range	
	Low	High
OATS – 1	00	33
OATS – 2	34	67
OATS – 3	68	99

The SG 222 provides an ESN routing method. The ESN routing method shall

15 route Submit\_SM PDUs with the same service\_type to one of a group of MCs 224<sub>1</sub>-224<sub>x</sub> based on the value of the ESN in the short\_message parameter. The ESN routing method shall allow a group of MCs 224<sub>1</sub>-224<sub>x</sub> delivering the same service\_type to be defined. The group shall contain two or more MCs 224<sub>1</sub>-224<sub>x</sub>. The ESN routing method supports two routing options:

- 20 1. When an ESN routing group contains two OATS MCs 224<sub>1</sub>-224<sub>x</sub>, routing shall be based on the odd or even value of the decimal ESN.
2. When an ESN routing group contains more than two OATS MCs 224<sub>1</sub>-224<sub>x</sub>, routing shall be based on the value of the last two digits of the decimal ESN.

25

When the ESN routing group contains two MCs 224<sub>1</sub>-224<sub>x</sub>, one MC 224<sub>1</sub>-224<sub>x</sub> is defined to receive activation requests containing even ESNs in the short\_message parameter and one MC 224<sub>1</sub>-224<sub>x</sub> is defined to receive activation requests containing - odd ESNs in the short\_message parameter. The requirements in the following

5 paragraph apply only to routing to more than two MCs 224<sub>1</sub>-224<sub>x</sub>.

When the ESN routing group contains more than two MCs 224<sub>1</sub>-224<sub>x</sub>, the ESN routing method requires an ESN range be defined for each destination MC 224<sub>1</sub>-224<sub>x</sub> in the group. The ESN range used by the ESN routing method is defined by a low and high value for the last two digits of the ESN. The ESN routing method does not allow

10 overlapping ESN ranges to be defined for a specific service\_type. The ESN routing method for a specific service\_type shall not become effective unless the ESN range definition is complete and provides for routing of any ESN (last two digits from 00 through 99).

If the destination MC 224<sub>1</sub>-224<sub>x</sub> for the ESN is not available, the ESN routing

15 method responds to the ESME with a command\_status of service type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs if the SG 222 cannot route a message to an MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to deliver the service\_type are unavailable.

The column of Table 4 labeled Query Supported represents support for

20 Query\_SM, Cancel\_SM, and Replace\_SM operations. The Submit\_SM\_Resp, Data\_SM\_Resp, and Submit\_Multi\_Resp signals return a unique message\_id to the sending ESME 202 for each message submitted. The message\_id uniquely identifies the message and the MC 224<sub>1</sub>-224<sub>x</sub> that sent the message. The ESME 202 populates the message\_id parameter in the Query\_SM, Cancel\_SM, and Replace\_SM operations with

25 the message\_id returned in the original submission. The Query\_SM, Cancel\_SM, and Replace\_SM operations are discussed in more detail below. The SG 222 uses the

message\_id to route the message to the correct MC 224<sub>1</sub>-224<sub>x</sub>. The MC 224<sub>1</sub>-224<sub>x</sub> uses the message\_id and associated parameters received in the message to perform the requested operation.

To make most efficient use of MC 224<sub>1</sub>-224<sub>x</sub> and wireless network resources, RIP are used by the ESME 202 when possible. To effectively implement RIP, all messages for the same service type and destination address (MDN) must be routed to the same MC 224<sub>1</sub>-224<sub>x</sub> for delivery. If a pending message for the service type and destination address (MDN) is present, it is replaced with the new message. This is not a problem when only one MC 224<sub>1</sub>-224<sub>x</sub> delivers a service. When a group of MCs 224<sub>1</sub>-224<sub>x</sub> delivers the same service, the problem is determining which MC 224<sub>1</sub>-224<sub>x</sub> in the group may contain a pending message that should be replaced by the current message.

Several solutions are possible:

1. Allow all MCs 224<sub>1</sub>-224<sub>x</sub> delivering a service to access a shared database of pending messages. RIP could then be implemented effectively by a group of MCs 224<sub>1</sub>-224<sub>x</sub>. Current MC 224<sub>1</sub>-224<sub>x</sub> architecture does not support this approach.
2. Establish a routing type at the SG 222 that routes a delivery request to the same MC 224<sub>1</sub>-224<sub>x</sub> given service type and destination address.

Routing by MDN range implements option two above. For example, a service type requiring RIP is delivered by multiple MCs 224<sub>1</sub>-224<sub>x</sub>. An NPA range is established, in the SG 222, for each MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 routes messages to the MCs 224<sub>1</sub>-224<sub>x</sub>, based on service type and NPA of the destination address (MDN). Subsequent messages for the same service type and MDN are routed to the same MC 224<sub>1</sub>-224<sub>x</sub> using the MDN of the destination address. If RIP is requested and a message is pending, it is replaced at the MC 224<sub>1</sub>-224<sub>x</sub>.

With this routing method the MDN range has no significance to the MC 224<sub>1</sub>-224<sub>x</sub> or in the wireless network; it is only used as a routing mechanism between the SG 222 and MC 224<sub>1</sub>-224<sub>x</sub>.

We now turn to routing methods for mobile originated messaging. The MO routing methods apply for MC 224<sub>1</sub>-224<sub>x</sub> to ESME 202 routing. A MO service type can have one of the following routing methods, illustrated in Table 9:

5

ESME Specific	Route all messages for this service type to a specific ESME.
Load Balancing	Route messages to a group of ESMEs based on load capabilities of each ESME in the group. Each ESME in the group is allocated messages based on its capacity.
Equal Allocation	Route messages to a group of ESME based on sequentially sending messages to each MC in the group. Each ESME in the group gets an equal number of messages.
Destination IP Address	Route messages to destination based on IP address contained in destination_address parameter of Deliver_SM and Data_SM.
Destination Address	Route message to a destination ESME based on the value of the destination_addr parameter received in the Deliver_SM and Data_SM PDUs

10

The following Table 10 describes the SMPP PDUs and parameters used for each MO routing method.

Routing Method	SMPP PDUs	SMPP Parameters Used for Routing
ESME Specific	Deliver_SM Data_SM	-service_type
Load Balancing	Deliver_SM Data_SM	-service_type
Equal Allocation	Deliver_SM Data_SM	-service_type

Destination IP Address	Deliver_SM Data_SM	-destination_address -service_type
Destination Address	Deliver_SM Data_SM	-destination_address -service_type

For destination address routing, the destination\_address parameter contains the IP address of the destination ESME 202. The SG 222 routes to the ESME 202 using the IP address in the destination\_address parameter. Routing is subject to destination ESME 202 being bound and anti-spam check based on service\_type parameter.

For the ESME 202 specific routing method, the SG 222 routes all Deliver\_SM and Data\_SM PDUs with the same service\_type to the same ESME 202. The ESME Specific routing method allows a primary and alternate destination ESME 202 to be defined. Definition of an alternate ESME 202 is not mandatory. The ESME 202 Specific routing method routes the MO message to the primary destination ESME 202 if the primary ESME 202 is available. The ESME 202 Specific routing method routes the MO message to the alternate destination ESME 202 if the primary ESME 202 is not available. If both primary and alternate ESMEs 202 are unavailable, the ESME 202 specific routing method responds to the MC 224<sub>1</sub>-224<sub>x</sub> with a command\_status of service type not available in the Deliver\_SM\_Resp or Data\_SM\_Resp PDUs if the SG 222 cannot route a message to an ESME because all the ESMEs defined to receive the service\_type are unavailable.

The Load Balancing routing method routes messages to a group of ESMEs 202 based on load capabilities of each ESME 202 in the group. Each ESME 202 in the group is allocated messages based on its capacity. Table 11 illustrates the message allocation:

ESME in Group	Proportion of Messages Allocated
---------------	----------------------------------



ESME – 1	25%
ESME – 2	50%
ESME – 3	25%
Total	100%

The SG 222 provides a load balancing routing method for MO messages. The load balancing routing method routes all Deliver\_SM or Data\_SM PDUs with the same service\_type to one of a group of ESMEs 202 based on the load allocation established for each ESMEs 202. The load balancing routing method allows a group of ESMEs 202 delivering the same service\_type to be defined. The defined group contains two or more ESMEs 202. The load balancing routing method allows the proportion of messages allocated to each ESME 202 in the group to be defined. The proportion is defined as a percentage of messages allocated to each ESME 202. The load balancing routing method further routes messages to each of the ESMEs 202 in the load balancing group based on proportion of messages allocated to each ESME 202.

Using the example above, if 100 messages are routed for a service type in some time interval, the ESME-1 will receive 25 messages, the ESME -2 will receive 50 messages and the ESME -3 will receive 25 messages. The load balancing routing method routes messages to each of the ESMEs 202 in the group based on the proportion of messages allocated to it. If an ESME 202 in a load balancing routing method group becomes unavailable, the messages destined for the unavailable ESME 202 are routed to the remaining ESMEs 202. The messages are allocated to the remaining available ESMEs 202 based on the remaining ESMEs 202 allocation of total capacity. The allocation added to each remaining ESME 202 equals the allocation lost / number of remaining ESMEs 202.

Using the example above, if the ESME-3 becomes unavailable, then the allocation added to each remaining ESME = allocation lost / number of remaining ESMEs. The result of the allocation added to each of the remaining ESMEs = 25% / 2

(=12.5%). ESME-1 is now allocated 37.5% of the total (25% + 12.5% from ESME-3) and ESME-2 is allocated 62.5% of the total (50% + 12.5% from ESME-3). If all ESMEs 202 in a load balancing routing group become unavailable, the routing method responds to the MC 224<sub>1</sub>-224<sub>x</sub> with a command\_status of service type not available in the Deliver\_SM\_Resp or Data\_SM\_Resp PDUs if the SG 222 cannot route a message to an ESME 202 because all the ESMEs 202 defined to receive the service\_type are unavailable.

The SG 222 also provides for routing according to the equal allocation method. According to the equal allocation method, all Deliver\_SM and Data\_SM PDUs are routed with the same service\_type to one of a group of ESMEs 202 based on sequentially sending messages to each ESME 202 in the group. The equal allocation routing method allows a group of ESMEs 202 delivering the same service\_type to be defined. The group contains two or more ESMEs 202. The equal allocation routing method sends an equal number of messages to each ESME 202 in the group. One message shall be sent to each of the destination ESMEs 202 before any destination ESME 202 is sent another message. If all ESMEs 202 in an equal allocation routing group become unavailable, the routing method responds to the MC 224<sub>1</sub>-224<sub>x</sub> with a command\_status of service type not available in the Deliver\_SM\_Resp or Data\_SM\_Resp PDUs if the SG 222 cannot route a message to an ESME 202 because all the ESMEs 202 defined to receive the service\_type are unavailable.

Another routing method is the destination IP address routing method. According to the destination IP address routing method, the SG 222 routes all Deliver\_SM and Data\_SM PDUs with the same service\_type to the address contained in the destination\_address parameter.

The destination address routing method differs from the destination IP address routing method as follows. The SG 222 provides a destination address routing method

for MO messages. The destination address routing method routes all Deliver\_SM and Data\_SM PDUs with the same service\_type to a destination ESME 202 based on the value of the first four digits of the destination\_addr parameter. The first four digits of the destination\_addr parameter identify the ESME 202 to which the message should be

5 routed. The destination address routing method allows destination address values to be assigned to an ESME 202. It is possible to assign more than one destination address value to an ESME 202. The destination address assigned to an ESME 202 is four digits in length. Valid destination address values are 0000 to 9999. The destination address routing method routes the Deliver\_SM and Data\_SM PDUs to the destination ESME

10 202 based on the value of the first four digits of the destination\_addr parameter received in the Deliver\_SM and Data\_SM PDUs.

The SG 222 maintains an association between the four-digit destination address value and an ESME 202. An example is shown in the following Table 12.

Destination address value	ESME
0000	e-mail hub
1234	ESME A
1236	ESME B
1237	ESME B
2570	ESME C

15 Given the destination address to ESME 202 associations shown in the previous table, the following Table 13 shows example routings.

-destination_addr Parameter Value	Route To
0000xxxx	e-mail hub
1234xxxx	ESME A
1234x	ESME A
2570	ESME C
7230	Return error code
1236xxxx	ESME B
1237	ESME B

If the value received in the first four digits of the destination\_addr parameter does not correspond to any defined destination address values, the SG 222 returns an Invalid Dest Addr (0x0000000B) error code to the MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 issues an alarm when an Invalid Dest Addr (0x0000000B) error code is sent to a MC 224<sub>1</sub>-224<sub>x</sub>.

- 5 The minimum information provided includes time, service type, source MC 224<sub>1</sub>-224<sub>x</sub>, and destination\_addr of message. Other information may be provided.

The SG 222 logs all occurrences of an Invalid Dest Addr (0x0000000B) error code being sent to an MC 224<sub>1</sub>-224<sub>x</sub>. The minimum information provided includes time, service type, source MC, and destination\_addr of message. Other information may be  
10 provided.

If the destination ESME 202 for the destination address is not available, the SG 222 responds to the MC 224<sub>1</sub>-224<sub>x</sub> with a command\_status of Service Type Not Available in the Deliver\_SM\_Resp or Data\_SM\_Resp PDUs if the SG 222 cannot route a message to an ESME 202 because all ESMEs 202 defined to receive the service\_type  
15 are unavailable.

Having discussed both the MT and MO routing methods, we now turn to a discussion of the message\_id parameter. The message\_id parameter is returned to an ESME 202 by the MC 224<sub>1</sub>-224<sub>x</sub> when a message is submitted for delivery. The message\_id value is used subsequently by the ESME in Query, Cancel, and Replace  
20 (QCR) operations. The SG 222 supports three message\_id mapping modes. These are summarized in the following Table 14:

message_id Mapping Mode	Description
Mode 1 – unique message_id applied at MC	MC provides unique message_id values within a specific range. SG routes QCR PDUs based on message_id range to MC mapping maintained at SG.
Mode 2 – unique message_id applied at SG	SG prepends a message center ID value to message_id parameter

	received from MC. SG routes QCR PDUs based on message center ID value mapping maintained at SG.
Mode 3 – Query, Cancel, Replace not supported at SG	The SG rejects all QCR PDUs.

When mode – 1 message\_id mapping is selected, the SG 222 uses the provisioned MC 224<sub>1</sub>-224<sub>x</sub> message\_id range to route Cancel\_SM, Replace\_SM, and Query\_SM PDUs to destination MCs 224<sub>1</sub>-224<sub>x</sub>.

- 5 If the MC 224<sub>1</sub>-224<sub>x</sub> cannot provide unique message\_id values in response PDUs, the SG 222 will provide this function. This is accomplished at the SG 222 by prepending a unique message center ID (MCID) value to the message\_id value returned by the MC 224<sub>1</sub>-224<sub>x</sub> in the Submit\_SM\_Resp, Submit\_Multi\_Resp, Data\_SM\_Resp, and Deliver\_SM\_Resp PDUs. The SG 222 also is required to remove the prepended MCID
- 10 values in Query\_SM, Cancel\_SM, and Replace\_SM PDUs.

- The modified message\_id will have the form of MCID + message\_id. Note that message ID mapping at SG 222 is only required to support Cancel\_SM, Replace\_SM and Query\_SM operations. The discussion below on MC Provisioning provides further details regarding the MCID, message ID mapping at SG 222, and MC message\_id range
- 15 parameters.

- The SG 222 provides a message ID mapping at SG master on / off setting for each MC 224<sub>1</sub>-224<sub>x</sub>. If message ID mapping at SG 222 is set to on for a MC 224<sub>1</sub>-224<sub>x</sub>, then the SG 222 requires a unique MCID value be defined for that MC 224<sub>1</sub>-224<sub>x</sub>. The MCID values are unique to a MC 224<sub>1</sub>-224<sub>x</sub>. If the message ID mapping at the SG 222 is
- 20 set to off, then the SG 222 does not provide unique message\_id mapping for the MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 assumes that the MC 224<sub>1</sub>-224<sub>x</sub> provides unique message\_id values as defined by the MC message\_id range parameter. The SG 222 provides a

configurable MCID value for each MC 224<sub>1</sub>-224<sub>x</sub> defined at the SG 222. The MCID value is configurable between 001 and 999.

When the SG 222 receives a Submit\_SM\_Resp, Submit\_Multi\_Resp, Data\_SM\_Resp, or Deliver\_SM\_Resp PDU and message ID mapping at SG 222 is set to on, then the SG 222 prepends the MCID value to the message\_id value returned from the MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 then sends the response PDU containing the modified message\_id to the destination ESME 202. When the SG 222 receives a Query\_SM, Cancel\_SM, or Replace\_SM PDU with a message center ID prepended to the message\_id, the SG 222 removes the MCID from the message\_id. The SG 222 then sends the PDU containing the message\_id (with MCID removed) to the destination MC 224<sub>1</sub>-224<sub>x</sub>.

The SG 222 uses the MCID prepended to the message\_id in the Query\_SM, Cancel\_SM, or Replace\_SM PDUs to route the PDU to the correct MC 224<sub>1</sub>-224<sub>x</sub>. The PDU is routed to the MC 224<sub>1</sub>-224<sub>x</sub> identified by the MCID. If the SG 222 receives a Query\_SM, Cancel\_SM, or Replace\_SM PDU with a message\_id without a MCID prepended, the SG 222 attempts to route the PDU using the MC message\_id range parameter provisioned for the MC 224<sub>1</sub>-224<sub>x</sub>. If the routing attempt fails, the SG 222 returns Service type not available error code to the originating ESME 202.

When message\_id mapping mode 3 is selected, Query, Cancel, and Replace PDUs are rejected at the SG 222. The SG 222 rejects these PDUs with the appropriate error code. When mode – 3 message\_id mapping is selected, the SG 222 rejects (1) all Cancel\_SM PDUs with the Cancel\_SM Failed error code, (2) all Query\_SM PDUs with the Query\_SM Failed error code, and (3) all Replace\_SM PDUs with the Replace\_SM Failed error code.

The message\_id mapping mode is configurable at the SG 222. Mode one, two, or three may be selected.

We will next discuss the query, cancel, and replace commands. The SG 222 supports receiving Query\_SM and Query\_SM\_Resp PDUs. When the SG 222 receives a Query\_SM PDU, it routes the message to the MC 224<sub>1</sub>-224<sub>x</sub> identified by the message\_id parameter. When the SG 222 receives a Query\_SM\_Resp, it routes the message to the originating ESME 202. If the destination MC 224<sub>1</sub>-224<sub>x</sub> is unavailable or the message\_id parameter does not map to a known MC 224<sub>1</sub>-224<sub>x</sub>, the SG 222 responds to the ESME 202 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs if the SG 222 cannot route a message to a MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to deliver the service\_type are unavailable.

The SG 222 supports receiving Cancel\_SM and Cancel\_SM\_Resp PDUs. When the SG 222 receives a Cancel\_SM PDU with a message\_id value that is not null, it will route the message to the MC 224<sub>1</sub>-224<sub>x</sub> identified by the message\_id parameter. When the SG 222 receives a Cancel\_SM\_Resp, it routes the message to the originating ESME 202. When the SG 222 receives a Cancel\_SM PDU with a message\_id value that is null, it routes the message to the MC based on the service\_type parameter. If the service\_type is defined with the MC Specific or MDN Range routing methods, the Cancel\_SM PDU is routed according to the rules of the routing method. If the service\_type is defined with any other routing method, the SG 222 responds to the ESME 202 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs if the SG 222 cannot route a message to a MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to deliver the service\_type are unavailable.

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If the destination MC 224<sub>1</sub>-224<sub>x</sub> is unavailable or the message\_id parameter does not map to a known MC 224<sub>1</sub>-224<sub>x</sub>, the SG 222 responds to the ESME 202 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs if the SG 222 cannot route a message to a

5 MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to deliver the service\_type are unavailable.

The SG 222 supports receiving Replace\_SM and Replace\_SM\_Resp PDUs. When the SG 222 receives a Replace\_SM PDU, it routes the message to the MC 224<sub>1</sub>-224<sub>x</sub> identified by the message\_id parameter. When the SG 222 receives a

10 Replace\_SM\_Resp, it routes the message to the originating ESME 202. If the destination MC 224<sub>1</sub>-224<sub>x</sub> is unavailable or the message\_id parameter does not map to a known MC 224<sub>1</sub>-224<sub>x</sub>, the SG 222 responds to the ESME 202 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs if the SG 222 cannot route a message to a MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-

15 224<sub>x</sub> defined to deliver the service\_type are unavailable. The SG 222 also supports the Enquire\_Link and Enquire\_Link\_Resp PDUs, as well as the Alert\_Notification PDU, which the SG 222 routes using the esme\_addr parameter.

The SG 222 maintains the operation states of MCs 224<sub>1</sub>-224<sub>x</sub>, ESMEs 202, and service types. The ESMEs 202 and service type may be disabled administratively. An

20 ESME 202 may be prohibited from binding to the SG 222. A service type may be unavailable at the router because of administrative action or because all of the MCs 224<sub>1</sub>-224<sub>x</sub> or ESMEs 202 that provide that service type are unavailable. The SG 222 monitors the operating state of all the MCs 224<sub>1</sub>-224<sub>x</sub> that it is configured to route to. A MC 224<sub>1</sub>-224<sub>x</sub> has states of available or unavailable. The available state indicates that the MC is



operating normally. The unavailable state indicates that the MC 224<sub>1</sub>-224<sub>x</sub> is not available and no messages will be routed to it.

The SG 222 maintains the permission state of all ESMEs 202 that it is configured to route to. An ESME 202 contains states of allowed or prohibited. The allowed state indicates that the ESME 202 is permitted to bind to the SG 222 and send  
5 and/or receive messages. The prohibited state indicates that the ESME 202 is not permitted to bind to the SG 222. If an ESME 202 with a state of prohibited attempts to bind to the SG 222 the SG 222 responds with a command\_status of ESME Prohibited. If an ESME 202 is bound to the SG 222 and its state is changed to prohibited through  
10 administrative action, the SG 222 cancels the ESME's bind.

A service type may become unavailable for two reasons: First, all MCs 224<sub>1</sub>-224<sub>x</sub> or ESMEs 202 delivering that service type become unavailable; and second, an administrator changes the state of service type to unavailable at the SG 222 to prohibit access to that service type. The SG 222 maintains the availability state of all service types  
15 to which it is configured to route. A service type has the states of available or unavailable. The available state indicates that the service type is available to ESMEs 202 (MT case) or MCs 224<sub>1</sub>-224<sub>x</sub> (MO case) for routing. The unavailable state indicates the service type is not available to ESMEs 202 (MT case) or MCs 224<sub>1</sub>-224<sub>x</sub> (MO case).

If a service type has a state of unavailable the SG 222 responds to the ESME 202  
20 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs if the SG 222 cannot route a message to a MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to deliver the service\_type are unavailable for MT services. The SG 222 responds to the MC 224<sub>1</sub>-224<sub>x</sub> with a command\_status of Service Type Not Available in the Deliver\_SM\_Resp or

Data\_SM\_Resp PDUs if the SG 222 cannot route a message to an ESME 202 because all ESMEs 202 defined to receive the service\_type are unavailable, for MO services.

All changes to Service Type, ESME, and MC provisioning parameters are logged in an event log. The minimum information provided includes time, user id of person making the change, previous parameter value, and new parameter value. Additional information may also be provided.

The SG 222 provides a user interface for service type provisioning and configuration reporting. At a minimum, the SG 222 provides the following configurable parameters for each service type as shown in Table 15:

Parameter	Description	Values
Service type	Identification of service type used in the service_type parameter	Implementation specific
Service termination type	Termination type of the service	MT or MO
Routing method	Routing method for service type	For MT services: 1. MC Specific 2. Load Balancing 3. MDN Range 4. Equal Allocation 5. ESN  For MO services: 1. ESME Specific 2. Load Balancing 3. Equal Allocation 4. Destination IP Address 5. Destination Address
Anti-Spam Check required	Determines if all messages for this service type require an anti-spam check or not	Yes or no
Anti-Spam Check unavailable default action	If D2 is unavailable, the SG can either allow all messages for the service type or deny all messages for the service type until D2 becomes available.	1. Allow all messages 2. Deny all messages

Parameter	Description	Values
	This parameter defines which action to take.	
Service type availability	Service type availability allows an operator to make a service type available or unavailable	Available or unavailable

MT services are only assigned MT routing methods. MO services are only assigned MO routing methods. For ESME 202 provisioning, the SG 222 provides a user interface for ESME 202 provisioning and configuration reporting. At a minimum, the

5 SG 222 provides the following configurable parameters for each ESME 202 as shown in Table 16:

Parameter	Description	Values
ESME system id	ESME system identification corresponding to the system_id parameter.	Implementation specific
ESME password	Password for ESME corresponding to the password parameter.	Implementation specific
Authorized service types	List of services that the ESME is authorized to request delivery of. These correspond to the service_type parameter.	Implementation specific
Throttle control limit	The throttle control limit specifies the maximum number of messages per second an ESME is allowed to send to the SG. When this limit is exceeded, the SG invokes throttle for that ESME.	Default = 1 msg/sec Minimum = 0.1 msg/sec Maximum = 500 msg/sec
ESME permission state	The ESME state allows an operator to allow or prohibit an ESME from binding to the SG.	Allowed or prohibited

For MC provisioning, the SG 222 provides a user interface for MC provisioning and configuration reporting. At a minimum, the SG 222 provides the following configurable parameters for each MC 224<sub>1</sub>-224<sub>x</sub>, shown in Table 17:

Parameter	Description	Values
MC bind parameters 1. System_id 2. Password 3. System_type 4. Interface_version 5. Addr_ton 6. Addr_npi 7. Address_range	As specified in SMPP V3.4 protocol specification.	Implementation specific
MC message_id range	Each MC has a unique range of values that are populated in the message_id parameter. The SG must maintain a mapping of message_id to MC to route query operations.	Implementation specific
MC availability	MC availability allows an operator to make a MC available or unavailable.	Available or unavailable
Flow Control Gap Timer	Gap timer value for flow control when the MC indicates congestion.	Minimum = 1 second Default = 60 seconds Maximum = 600 seconds
Message center ID (MCID)	A unique three digit identifier associated with a MC for message_id mapping at the SG.	Minimum = 000 Maximum = 999
Message ID mapping at SG	Determines if the SG does message id mapping for this message center.	On or Off

5 We now turn to more details regarding anti-spamming according to the present invention. The D2 220 provides anti-spam check capability for MO and MT messages. For MT messages, spam is defined as the number of MT delivery requests for a specific MS 236 exceeding a predefined number within a specific time interval. For example,

spam for a particular service type may be defined as 20 delivery requests within three minutes. For MO messages, spam is preferably defined as the number of MO delivery requests from a specific MS 236 exceeding a predefined number within a specific interval. Other variations on how spam is defined may be provided as would be  
5 understood by one of ordinary skill in the art.

The following description is based on the following assumptions: (1) From the SG 222 perspective, the D2 220 provides MDN-based anti-spam check capabilities; (2) For MT messages from e-mail addresses, a source address anti-spam check will have been performed before the message is delivered to the SG 222; and (3) For performance  
10 and capacity purposes, it is preferably assumed that 100% of MO message require anti-spamming (AS) check and 50% of MT messages require AS check.

An interface between the SG 222 and the D2 220 will be used to perform the anti-spamming according to the present invention. With the details of the parameters and information disclosed herein, the appropriate interface between the SG 22 and the  
15 D2 220 may be implemented by those of skill in the art.

An exemplary anti-spam algorithm will next be described. The D2 220 contains a list of barred MDNs. A MDN becomes barred if:

1. The MT anti-spam threshold for the MDN is exceeded;
2. The MO anti-spam threshold for the MDN is exceeded; or
- 20 3. The MDN has been placed on the barred list by administrative action.

The D2 220 provides a MT anti-spam threshold and a MO anti-spam threshold. The MT and MO anti-spam thresholds are configurable. Their configuration consists of a number of delivery requests and the associated time interval. When a MDN exceeds either anti-spam threshold (MT or MO), it is placed on the barred list for a specific

period of time, which may be referred to as the barred interval. When the barred interval expires, the MDN is removed from the barred list. The barred interval is configurable, one value for MO and one value for MT with units of minutes, days, or permanent. The D2 220 allows a MDN to be manually added to or removed from the barred list. When  
5 a MDN is added to the barred list manually, the user is given the option of applying the currently defined barred interval or permanently barring the MDN.

The manner of performing an anti-spam check is next described. The D2 220 is capable of receiving an AS\_Check query populated with destination\_address, service\_type, and replace\_if\_present\_flag(RIP).

10 The RIP flag allows a message pending delivery at an MC to be replaced by a new message. For example, assume that a message for a specific MDN is pending delivery at the MC. A new message arrives for the MDN. Two actions are possible. First, the new message is added to the queue of messages for the MDN and, when available, the mobile receives all messages from the queue. Another possibility is to replace (RIP) the  
15 message, so that only one message is pending for a MDN at any one time. When combined with service type, RIP can be useful for delivering messages that are only valuable for a short period of time. For example, with weather reports, a subscriber would only want the most recent report, not all the ones that were missed. Therefore messages for this type of service would use RIP. This also applies to messages used to  
20 program mobiles. E-mail messages would not use RIP because a subscriber wants to receive all of their e-mails, not just the most recent one.

The D2 220 checks if the MDN in destination\_address is on the barred list. If MDN is on the barred list, the D2 220 returns a "deny" in AS\_Check\_Resp. If the MDN is not on the barred list, the D2 220 returns an "allowed" in AS\_Check\_Resp.  
25 After receiving an AS\_Check query and sending an AS\_Check\_Resp, the D2 220 updates

its MT anti-spam threshold counters for the MDN associated with the query. If the MT anti-spam threshold value is exceeded for the MDN, the D2 220 places the MDN on the barred list.

A mobile originated message anti-spam check is next described. The D2 220 is capable of receiving a AS\_Check query populated with destination\_address, service\_type, and source\_address. The D2 220 checks if the MDN in source\_address is on the barred list. If MDN is on the barred list, the D2 220 returns a “deny” in AS\_Check\_Resp. If the MDN is not on the barred list, the D2 220 returns an “allowed” in the AS\_Check\_Resp signal. After receiving an AS\_Check query and sending an AS\_Check\_Resp, the D2 220 updates its MO anti-spam threshold counters for the MDN associated with the query. If the MO anti-spam threshold value is exceeded for the MDN, the D2 220 places the MDN on the barred list.

The D2 220 does not require MDNs to be provisioned. The MDNs are added to the barred list based on queries received from the SG 222 or through administrative action.

A transaction is defined as receiving an AS\_Check query and responding with an AS\_Check\_Resp. The D2 220 is capable of scaling to meet future capacity requirements for anti-spam checking of MT, MO, and total messages, as described in the following

Table 18:

Year	MT TPS	MO TPS	Total TPS
1	27	1	28
2	135	15	150
3	439	56	495

The D2 220 provides a utility to configure and report MT anti-spam threshold, MO anti-spam threshold, MT barred interval, MO barred interval, MDNs on barred list, and MDNs placed on barred list manually. The D2 220 also provides a utility to manually add or remove a MDN from the barred list.

5       The mobile terminated (MT) message delivery protocol, with an anti-spamming check, is next described. The ESME 202 submits messages for MT delivery using Submit\_SM including service\_type and destination\_address (MDN). The SG 222 checks for the service\_type parameter in Submit\_SM. If the service type has anti-spam check enabled, the SG 222 sends an 'AS\_Check' message to the D2 220. The D2 220 checks  
10   the destination address, or mobile destination number (MDN) and service\_type against anti-spam thresholds. For example, a query may indicate that thresholds have not been exceeded. If this is the case, the D2 220 returns status of 'allow' to the SG 222. The SG 222 routes the Submit\_SM signal to the destination MC 224<sub>1</sub>-224<sub>x</sub>. The destination MC 224<sub>1</sub>-224<sub>x</sub> returns a Submit\_SM\_Resp signal to the SG 222. The SG 222 also returns a  
15   Submit\_SM\_Resp signal to the ESME 202. The D2 220 then sends an Update signal to DUE Server 218 to update its anti-spam counters. The DUE Server 218 responds to the D2 220 with an Update\_Resp signal containing the new status.

      The MT message delivery protocol for an unsuccessful anti-spam check is next described. The ESME 202 submits a message for MT delivery using the Submit\_SM  
20   signal including service\_type and destination\_address. The SG 222 checks the service\_type parameter in the signal Submit\_SM. If the service type has anti-spam check enabled, the SG 222 sends an 'AS\_Check' message to the D2 220. Parameters include service\_type and destination\_address (MDN). The D2 220 checks the MDN and service\_type against anti-spam thresholds. If a query indicates that thresholds have been  
25   exceeded, the D2 220 returns status of 'deny' to the SG 222. The SG 222 sends a



Submit\_SG\_Resp signal with command\_status set to 'service denied' to the ESME 202.

The D2 220 sends an Update signal to the DUE Server 218 to update its anti-spam counters. Finally, the DUE Server 218 responds to D2 220 with an Update\_Resp signal that contains a status.

- 5           FIG. 7 illustrates the communication between an ESME 202, SG 222 and MC 224<sub>1</sub>-224<sub>x</sub> for MT message delivery. An ESME 202 sends a Submit\_SM signal to the SG 222. The service\_type parameter identifies the service to be delivered. The SG 222 invokes routing method based on service\_type and routing method dependent parameters to select destination MC. The primary destination MC 224<sub>1</sub>-224<sub>x</sub> is selected.
- 10   If primary destination MC 224<sub>1</sub>-224<sub>x</sub> is not available, a secondary MC 224<sub>1</sub>-224<sub>x</sub> is selected. If no MCs 224<sub>1</sub>-224<sub>x</sub> are available to deliver the service, the SG 222 returns a new error 'service type not available' in command\_status. The SG 222 sends Submit\_SM to destination MC 224<sub>1</sub>-224<sub>x</sub>. The destination MC 224<sub>1</sub>-224<sub>x</sub> replies with a Submit\_SM\_Resp signal. The message\_id parameter uniquely identifies the message and
- 15   the MC 224<sub>1</sub>-224<sub>x</sub> that sent the message. The SG 222 sends Submit\_SM\_Resp to the ESME 202.

- The replace\_if\_present\_flag (RIP) parameter is an optional parameter in Submit\_SM and Submit\_Multi. If the RIP option is included, the ESME 202 may send a Submit\_SM or Submit\_Multi signal to the SG 222 with replace\_if\_present\_flag set to
- 20   'Replace'.

- A message that includes the RIP flag indicates that this message should replace any message pending (for a specific mobile) delivery at the MC. If a message is received with the RIP flag set and a message is pending at the MC 224<sub>1</sub>-224<sub>x</sub>, the existing message (if there is one) is replaced. In this manner, the old or existing message is deleted.
- 25   Therefore there is only one message pending for a mobile at any one time.

For the RIP operation to work appropriately in the context of the present invention, the message must be routed using a deterministic routing method. A deterministic routing method is one that routes messages with the same service type and destination address to the same MC 224<sub>1</sub>-224<sub>x</sub>. All messages for the same service type and destination address must route to the same destination MC 224<sub>1</sub>-224<sub>x</sub> so it can be determined at the MC 224<sub>1</sub>-224<sub>x</sub> if a message is pending and needs to be replaced as specified by the RIP flag.

The SG 222 invokes a routing method such that a message is delivered to the MC 224<sub>1</sub>-224<sub>x</sub> that originally received the message. The primary destination MC 224<sub>1</sub>-224<sub>x</sub> is selected. Some routing methods do not support RIP. If the MC 224<sub>1</sub>-224<sub>x</sub> that originally received the message is not available, then the message is sent to the secondary MC 224<sub>1</sub>-224<sub>x</sub> defined for the service. The original message will not be replaced. However, the new message will be delivered. Thus, the subscriber may receive the same message twice. All other steps are the same as described above.

The message flow for Data\_SM is the same as for Submit\_SM described previously. The RIP is not a valid parameter in the Data\_SM parameter. The Data\_SM parameter may be used for interactive services.

MT service using the parameter Submit\_Multi will now be described. An ESME 202 may use Submit\_Multi specifying up to 254 destination addresses. The dest\_address(es) parameter contains either the destination addresses or a Distribution List Name. The distribution list name is a file containing the destination addresses. The Message flow for Submit\_Multi is the same as for Submit\_SM described previously. RIP is a valid parameter in Submit\_Multi. Routing is based on the first destination address in the dest\_address(es) parameter. For this approach to support RIP, the destination address list must be in the same order for each message to get routed to the

correct MC 224<sub>1</sub>-224<sub>x</sub>. To support the distribution list, name-only routing to a specific MC 224<sub>1</sub>-224<sub>x</sub> is supported.

The present invention protects the MCs 224<sub>1</sub>-224<sub>x</sub> and wireless network from undesirable or abusive messaging practices by providing address flow control and anti-spam checking. The objective of flow control is to protect the messaging complex 216 and wireless network from undesirably high MT message traffic. Each ESME 202 has a maximum number of messages it is authorized to send to the SG 222 in a specific period of time. If the limit is exceeded, service is temporarily suspended. All messages received from the ESME 202 during the suspension period are rejected with a command\_status  
10 indicating throttling.

The objective of anti-spam checking is to protect the messaging complex 216 and wireless network by prohibiting an unreasonably high number of messages from being sent to or received from a specific MS 236 in a short period of time. If the number of messages sent to or received from a specific MS 236 in a specific time interval is  
15 exceeded, then subsequent message delivery requests for that MS 236 are rejected for a configurable time interval.

Flow control may also be applied to MT services. Anti-spam is preferably applied to MT and MO services. For each service type, the SG 222 maintains a flow control limit and anti-spam check (ASC) required parameter. The flow control limit is the  
20 maximum number of messages that an ESME 202 is allowed to send to the SG 222 in a specific time interval. The ASC parameter identifies whether messages for the service type require anti-spam check.

The present invention provides MT flow control between an ESME 202 and the SG 222. This is illustrated in FIG. 8. The ESME 202 sends Submit\_SM to the SG 222.  
25 The SG 222 determines that ESME 202 has exceeded its flow control limit. The SG 222 returns Submit\_SM\_Resp with command\_status set to existing error code 'Throttling

error – ESME has exceeded allowed message limits’. Any SMPP message received from the ESME 202 during the suspension interval is rejected with the same throttling error message.

Regarding anti-spamming, the existing Detect Undesirable Email (DUE) capability is enhanced to support queries from the SG 222. This capability is referred to herein as the D2 220. For MT messages, spam is defined as the number of MT delivery requests for a specific MS 236 exceeding a predefined number within a specific time interval. For example, spam for a particular service type may be defined as 20 delivery requests within three minutes. For MO messages, spam is defined as the number of MO delivery requests from a specific MS 236 exceeding a predefined number within a specific interval.

The major functions of the D2 220 are: (1) Receive a query from the SG 222 containing the service type, source address and destination address; (2) For an MT service, the D2 220 updates its message delivery request counters for the MDN contained in the destination address parameter. If the number of delivery requests have been exceeded for the time interval, then the D2 220 returns a status of ‘deny’. Otherwise, the D2 220 returns a status of ‘allow’; (3) For an MO service, the D2 220 updates its message delivery request counters for the MDN contained in the source address parameter. If the number of delivery requests have been exceeded for the time interval, then the D2 220 returns a status of ‘deny’. Otherwise, the D2 220 returns a status of ‘allow’; and (4) the D2 220 maintains a list of denied MDNs. If the MDN is on the denied list, the D2 220 returns a status of ‘deny’.

FIG. 9 illustrates an exemplary protocol for communicating between an ESME 202, SG 222, D2 220, MC 224<sub>1</sub>-224<sub>x</sub>, and MSC 232 for a mobile originated message where the system has an anti-spam check. We will first discuss an example of when the anti-spam check is successful. The MC 224<sub>1</sub>-224<sub>x</sub> receives an SMDPP signal for MO

teleservice for delivery beyond the wireless network. The MC 224<sub>1</sub>-224<sub>x</sub> sends  
 Deliver\_SM including service\_type and source\_address parameters to the SG 222. The  
 SG 222 checks service\_type parameter in Deliver\_SM. If service type has anti-spam  
 check enabled, the SG 222 sends an 'AS\_Check' message to the D2 220. Parameters  
 5 include service\_type and source\_address (MDN). The D2 220 checks the MDN and  
 service\_type against anti-spam thresholds. Assume for this example that a query  
 indicates that thresholds have not been exceeded. The D2 220 returns status of 'allow' to  
 the SG 222. The D2 220 updates counts for MDN and service\_type based on data  
 received in AS\_Check and time received. The SG 222 routes a Deliver\_SM signal to the  
 10 destination ESME 202. The ESME 202 returns a Deliver\_SM\_Resp signal to the SG  
 222, which returns the Deliver\_SM\_Resp signal to the MC 224<sub>1</sub>-224<sub>x</sub>.

Next, we will discuss the example process when the anti-spam check was  
 unsuccessful. The MC 224<sub>1</sub>-224<sub>x</sub> receives the SMDPP signal for MO teleservice for  
 delivery beyond the wireless network. The MC 224<sub>1</sub>-224<sub>x</sub> sends a Deliver\_SM signal  
 15 including service\_type and source\_address parameters to the SG 222. The SG 222  
 checks service\_type parameter in Deliver\_SM. If the service type has anti-spam check  
 enabled, the SG 222 sends 'AS\_Check' message to the D2 220. The parameters sent  
 include service\_type and source\_address (MDN). The D2 220 checks source address  
 (MDN) and service\_type against anti-spam thresholds. Assume that a query indicates  
 20 that thresholds have been exceeded. The D2 220 returns status of 'deny' to the SG 222.  
 The D2 220 updates counts for MDN and service\_type based on data received in  
 AS\_Check and time received. The SG 222 sends a Deliver\_SM\_Resp signal with  
 command\_status set to 'service denied' to MC 224<sub>1</sub>-224<sub>x</sub>.

A combination flow control and anti-spam logic 400 is illustrated in FIG. 10.  
 25 The logic 400 of FIG. 10 applies for both MT and MO messages. For an MT message,

the SG 222 receives the MT message (404) and inquires whether the flow control limit is exceeded for the sending ESME (406). If yes, the SG 222 rejects the message and transmits a message that the flow control limit is exceeded (408). If the flow control limit for the ESME 202 is not exceeded (406), the process inquires whether the anti-spam procedure is enabled for that service type (410). If yes, an anti-spam query is sent to the D2 (412) and an anti-spam status is returned. If the anti-spam status is not allowed (414), the message is rejected and a response is provided that the anti-spam limit is exceeded and service is denied (416). If the anti-spam status is allowed, then the message is routed to the destination MC (418).

10 For a MO message received by the SG 402, the logic proceeds to step 410, and queries whether the anti-spam service is enabled for the service type 410. If yes, an anti-spam query is sent to D2 (412) and an anti-spam status is returned. If the anti-spam status is not allowed (414), the message is rejected and a response is provided that the anti-spam limit is exceeded and service is denied (416). If the anti-spam status is allowed, 15 then the message is routed to the destination MC (418).

The MT message processing logic 300 at the SG 222 is shown with reference to FIG. 11. The performance requirements for MT message processing logic are that the ST 222 has a response time of 100ms if no D2 220 query is required. The response time is defined as the time between receiving a PDU and subsequently routing and sending 20 the PDU to its destination. The SG 222 also imposes not more than 125ms latency if a D2 220 inquiry is required. Latency for this purpose is defined as the time between receiving a PDU and subsequently routing and sending the PDU minus the D2 220 response time.

FIG. 11 is intended to describe the required message processing logic and not to 25 dictate specific implementation details. When the SG 222 receives (302) a Submit\_SM,

Data\_SM, or Submit\_Multi PDU from an ESME 202, it checks the bind state (304) of the sending ESME 202. If the ESME 202 is not bound, the SG 222 rejects the message (306) and returns the appropriate error code in the response PDU (342). The SG 222 then waits for the next message 348. If the ESME 202 is bound, when the SG 222  
5 receives a Submit\_SM, Data\_SM, or Submit\_Multi PDUs from an ESME 202, it verifies that the ESME 202 is authorized to request delivery of the service identified by the service\_type parameter (308). If the ESME 202 is not authorized to request delivery of the service identified by the service\_type parameter, the SG 222 rejects the message and responds to the ESME 202 with a command\_status of ESME Not Authorized for  
10 Service Type in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs (310). Then the SG 222 waits for the next message (348).

ESMEs 202 are allowed to send messages to the SG 222 at a maximum rate. Messages in excess of the maximum rate are subject to throttle control by the SG 222. Throttle control enables the receiver 200 to control the messaging traffic through  
15 the system according to the system capabilities and available resources. A sliding window algorithm is used to limit an ESME 202 to a maximum message delivery rate. When the SG 222 receives a PDU from an ESME 202, it verifies that the ESME 202 has not exceeded its authorized throttle control limit (312). If the ESME 202 exceeds its throttle control limit, the SG 222 rejects the message and responds to the ESME 202  
20 with a command\_status of Throttling Error (ESME has exceeded allowed message limits) in the response PDU (314, 342). The SG 222 then waits for the next message. All messages received from an ESME 202 in excess of the throttle control limit are rejected by the SG 222 with a command\_status of Throttling Error. None of the excess messages are routed to a destination MC 224<sub>1</sub>-224<sub>x</sub>. The message flow diagrams  
25 according to FIG. 11 may also apply to the Submit\_Multi and Data\_SM PDUs.

The SG 222 logs all throttle control events to the event log. The minimum information provided includes time, ESME 202 subject to throttle control, number of messages rejected, and throttle control limit. Additional information may also be provided.

- 5           The SG 222 may issue an alarm at step 314 when throttle control is invoked for an ESME 202. The ESME 202 flow control alarm contains, at a minimum, time, ESME 202 subject to throttle control, number of messages rejected, and throttle control limit, plus other information if desired.

- The logic process shown in FIG. 11 also involves an anti-spam check. The
- 10   AS\_Check and AS\_Check\_Resp are logic messages exchanged between the SG 222 and the D2 220. When the SG 222 receives a Submit\_SM, Data\_SM, or Submit\_Multi PDU from an ESME 202 with a service\_type defined to require an anti-spam check (316), the SG 222 sends an AS\_Check request (318) to the D2 220. For MT services, the AS\_Check query contains the service\_type, source\_addr (if present), destination\_addr,
- 15   and replace-if-present indicator. If the AS\_Check\_Resp (320) has a value of deny, the SG 222 shall reject the message and respond to the ESME 202 with a command\_status of Service Denied in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs (322). If the AS\_Check\_Resp (320) has a value of allow, the SG 222 routes the Submit\_SM, Data\_SM, or Submit\_Multi PDU to the destination MC (324).

- 20           If the D2 220 is unavailable, the SG 222 applies the anti-spam unavailable default action defined for the service type. The default action defined for each service type can be set to allow or deny. If set to allow, then all messages requiring an Anti-Spam check are routed to the destination MC 224<sub>1</sub>-224<sub>x</sub> when the D2 220 is unavailable. If set to deny, then all messages requiring an Anti-Spam check are rejected with a
- 25   command\_status of Service Denied.



If the D2 220 is unavailable and the anti-spam unavailable default action defined for the service type is set to allow, the SG 222 routes all messages requiring an AS\_Check as if the AS\_Check\_Resp returned allow (320, 324). If the D2 220 is unavailable and the anti-spam unavailable default action defined for the service type is set to deny, the SG 222 routes all messages requiring an AS\_Check as if the AS\_Check\_Resp returned deny (320, 322).

The SG 222 logs all D2 220 outages to the event log. The minimum information provided includes time and reason for outage, plus additional information if desired. The SG 222 may issue an alarm when the D2 220 becomes unavailable. The D2 220 unavailable alarm contains, at a minimum, time and reason for outage, plus additional information may be provided.

The SG 222 issues a clearing alarm when the D2 220 becomes available. The minimum information provided includes time and indication that the D2 220 is available. Additional information may be provided. The SG 222 logs when the D2 220 becomes available after an outage. The minimum information provided shall include time and indication that D2 220 is available, plus additional information may be provided.

If the MT message successfully completes bind check, service authorization check, throttle control check, and anti-spam check, the SG 222 invokes the routing method (324) for the service identified by the service\_type parameter. The SG 222 sends the Submit\_SM, Data\_SM, or Submit\_Multi PDU to the MC 224<sub>1</sub>-224<sub>x</sub> identified by the routing method to determine whether the identified MC 224<sub>1</sub>-224<sub>x</sub> is available for the service type (326). The SG 222 receives the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDU from the destination MC 224<sub>1</sub>-224<sub>x</sub> and subsequently sends it to the originating ESME 202 unaltered. The SG 222 responds to the ESME 202 with a command\_status of Service Type Not Available in the Submit\_SM\_Resp,

Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs if the SG 222 cannot route a message to a MC 224<sub>1</sub>-224<sub>x</sub> because all MCs 224<sub>1</sub>-224<sub>x</sub> defined to delivery the service\_type are unavailable (328). The SG 222 issues an alarm when a MT Service Type is not available (328). The minimum information provided in the alarm includes the time, Service Type, and indication that MT Service Type is unavailable, plus other information may be provided.

The SG 222 logs when a MT Service Type becomes unavailable. The minimum information provided includes the time, Service Type, and indication that MT Service Type is unavailable. Other information may be provided. The SG 222 issues a clearing alarm when a MT Service Type becomes available. The minimum information provided includes the time, Service Type, and indication that MT Service Type is available plus other information.

The SG 222 also logs when a MT Service Type becomes available. The minimum information provided includes time, Service Type, and indication that MT Service Type is available and optionally other information. The SG 222 logs all occurrences of when the Service Type Not Available command\_status is returned to an ESME 202 (MT service type not available). The minimum information provided includes time, service type that could not be routed, and source ESME. Other information may be provided. The SG 222 responds to the ESME 202 with a command\_status of Invalid Service Type in the Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp PDUs if the service\_type parameter contains an unrecognized or undefined service type value.

If the identified MC 224<sub>1</sub>-224<sub>x</sub> is available for the service type (326), the process includes inquiring whether the MC 224<sub>1</sub>-224<sub>x</sub> is subject to flow control and whether no alternate MC 224<sub>1</sub>-224<sub>x</sub> is available (330). If yes, the MC 224<sub>1</sub>-224<sub>x</sub> is subject to flow control and no alternate MC 224<sub>1</sub>-224<sub>x</sub> is available, and if congestion exists, the message

is rejected (332) and a response is sent back (342) to the originating ESME 202. The SG 222 then waits for the next message (348). If the MC 224<sub>1</sub>-224<sub>x</sub> is subject to flow control and an alternate MC 224<sub>1</sub>-224<sub>x</sub> is available (330), the message is routed to the destination MC (334). A response from the destination MC 224<sub>1</sub>-224<sub>x</sub> is sent (344). An MC 224<sub>1</sub>-  
5 224<sub>x</sub> can initiate flow control by returning a command\_status of Congestion (346). If the MC 224<sub>1</sub>-224<sub>x</sub> response indicates congestion (346), and an alternate MC 224<sub>1</sub>-224<sub>x</sub> is available (336) for the service type, the SG 222 will route the message to the alternate MC 224<sub>1</sub>-224<sub>x</sub> as the destination MC (334). If an alternate MC 224<sub>1</sub>-224<sub>x</sub> is not available (336), the SG 222 returns the Congestion command\_status to the originating ESME 202  
10 and invoke flow control (338). The message is rejected due to congestion at the MC (340). A response is sent back (342) to the originating ESME 202 and the SG 222 waits for the next message (348). Flow control in this case is described more fully below in connection with FIG. 12.

If no test for congestion is desired, then step 346 shown in FIG. 11 may be  
15 omitted. In this case, the down-stream processes 336, 338 and 340 may be removed from FIG. 11 since following the received response from the destination MC 224<sub>1</sub>-224<sub>x</sub> in step 344, the process proceeds directly to sending a response signal to the originating ESME 202 in step 342.

FIG. 12 illustrates in more detail the flow control message sequence discussed  
20 above in FIG. 11. FIG. 12 shows two scenarios: (1) an MT message, with a congested MC 224<sub>1</sub>-224<sub>x</sub> and no alternative MC 224<sub>1</sub>-224<sub>x</sub> available and (2) an MT message, the MC 224<sub>1</sub>-224<sub>x</sub> is congested, and an alternate MC 224<sub>1</sub>-224<sub>x</sub> available. We will begin with the first scenario. The ESME 202 submits a message for MT delivery using Submit\_SM including service\_type and destination\_address. The SG 222 routes Submit\_SM to  
25 destination MC 224<sub>1</sub>-224<sub>x</sub>. The MC 224<sub>1</sub>-224<sub>x</sub> returns Submit\_SM\_Resp to SG 222 with



MT Routing Method	RIP Supported	Congestion Indication Returned to ESME
		2. If both primary and alternate MC (if defined) concurrently invoke flow control.

Next, we will discuss the second scenario where an alternate MC 224<sub>1</sub>-224<sub>x</sub> is available. In this case, the ESME 202 submits message for MT delivery using

Submit\_SM including service\_type and destination\_address. The SG 222 routes

- 5 Submit\_SM to the destination MC 224<sub>1</sub>-224<sub>x</sub>. The destination MC 224<sub>1</sub>-224<sub>x</sub> returns Submit\_SM\_Resp to the SG 222 with command\_status indicating congestion. An alternate MC 224<sub>1</sub>-224<sub>x</sub> is defined and available for the service\_type. The SG 222 routes the Submit\_SM to the alternate destination MC 224<sub>1</sub>-224<sub>x</sub>. The alternate destination MC 224<sub>1</sub>-224<sub>x</sub> returns a Submit\_SM\_Resp signal to the SG 222 indicating message accepted.
- 10 The SG 222 returns Submit\_SM\_Resp to the ESME 202.

When the SG 222 receives a Submit\_SM\_Resp, Data\_SM\_Resp, or Submit\_Multi\_Resp with a command\_status of Congestion and an alternate MC 224<sub>1</sub>-224<sub>x</sub> is defined and available for the service type, the SG 222 routes the message to the alternate MC 224<sub>1</sub>-224<sub>x</sub>. When the SG 222 receives a Submit\_SM\_Resp, Data\_SM\_Resp,

- 15 or Submit\_Multi\_Resp with a command\_status of Congestion and an alternate MC 224<sub>1</sub>-224<sub>x</sub> is not defined or available for the service type, the SG 222 returns the Congestion command\_status response to the ESME 202. The SG 222 invokes flow control for the destination MC 224<sub>1</sub>-224<sub>x</sub>. The SG 222 starts a gap timer when flow control is invoked for a MC 224<sub>1</sub>-224<sub>x</sub>. While the destination MC 224<sub>1</sub>-224<sub>x</sub> is subject to flow control while
- 20 the gap timer has not expired, the SG 222 does not route any messages to the destination MC 224<sub>1</sub>-224<sub>x</sub>. While the destination MC 224<sub>1</sub>-224<sub>x</sub> is subject to flow control while the gap timer has not expired, the SG 222 responds to all messages routed to the destination MC 224<sub>1</sub>-224<sub>x</sub> with a command\_status of Congestion. When the gap timer expires, the next message received for the destination MC 224<sub>1</sub>-224<sub>x</sub> is sent to the destination MC

224<sub>1</sub>-224<sub>x</sub>. If the destination MC 224<sub>1</sub>-224<sub>x</sub> responds with Congestion in the response command\_status, flow control continues. If the destination MC 224<sub>1</sub>-224<sub>x</sub> responds with a command\_status other than congestion, flow control is discontinued.

The SG 222 issues an alarm when flow control is invoked for an MC 224<sub>1</sub>-224<sub>x</sub>.

- 5 The MC 224<sub>1</sub>-224<sub>x</sub> flow control invoked alarm contains, at a minimum, time, MC 224<sub>1</sub>-224<sub>x</sub> subject to flow control, whether messages were routed to an alternate MC 224<sub>1</sub>-224<sub>x</sub> (if alternate MC is defined), or if congestion indication was returned to originating ESME 202. Additional information may be provided. The SG 222 logs when flow control is invoked for a MC 224<sub>1</sub>-224<sub>x</sub>. The minimum information provided includes time, MC
- 10 224<sub>1</sub>-224<sub>x</sub> subject to flow control, whether messages were routed to alternate MC 224<sub>1</sub>-224<sub>x</sub> (if alternate MC is defined), or if congestion indication was returned to originating ESME 202. Additional information may be provided.

- The SG 222 issues an alarm when flow control is discontinued for an MC 224<sub>1</sub>-224<sub>x</sub>. The MC 224<sub>1</sub>-224<sub>x</sub> flow control discontinued alarm contains, at a minimum, the
- 15 time, MC 224<sub>1</sub>-224<sub>x</sub> subject to flow control, duration flow control was in effect, and number of messages rejected during flow control. Additional information may be provided. The SG 222 logs when flow control is discontinued for a MC 224<sub>1</sub>-224<sub>x</sub>. The minimum information provided includes time, MC 224<sub>1</sub>-224<sub>x</sub> subject to flow control, duration flow control was in effect, and number of messages rejected during flow
- 20 control. Additional information may be provided.

FIG. 13 illustrates exemplary message processing for a MO message. FIG. 13 shows three different scenarios: (1) An MO message with no anti-spam; (2) an MO message with anti-spam check successful; (3) an MO message with anti-spam check unsuccessful.

- 25 We first discuss an MO message with no anti-spamming performed. The MC 224<sub>1</sub>-224<sub>x</sub> receives a SMDPP signal containing a MO message. The SMDPP contains the

TID, bearer data, source address, and destination address. The MC 224<sub>1</sub>-224<sub>x</sub> sends Deliver\_SM message to the SG 222 and the SG 222 invokes a routing method based on service\_type and destination\_addr to select a destination ESME 202. If no ESMEs 202 are available to deliver the service, the SG 222 returns an error of 'service type not available'. The MC 224<sub>1</sub>-224<sub>x</sub> then resends the message to the SG 222 at a later time. The SG 222 sends Deliver\_SM to the destination ESME 202. The destination ESME 202 replies with Deliver\_SM\_Resp signal. The SG 222 sends a Deliver\_SM\_Resp signal to the MC 224<sub>1</sub>-224<sub>x</sub>. The replace\_if\_present\_flag parameter is not used in Deliver\_SM; therefore the RIP option may not be available for MO messages.

- 10        The MC 224<sub>1</sub>-224<sub>x</sub> may use Data\_SM for delivering MO messages to the SG 222. Message flow for Data\_SM is the same as for Delivery\_SM described previously. RIP is not a valid parameter in the Data\_SM signal.

Next, we discuss the MO message delivery when the anti-spam check is successful. The MC 224<sub>1</sub>-224<sub>x</sub> receives a SMDPP for MO teleservice for delivery beyond wireless network. The MC 224<sub>1</sub>-224<sub>x</sub> sends Deliver\_SM including service\_type and source\_address parameters to the SG 222. The SG 222 checks service\_type parameter in Deliver\_SM. If service type has anti-spam check enabled, the SG 222 sends 'AS\_Check' message to the D2 220. Parameters include service\_type and source\_address (MDN). The D2 220 checks source address (MDN) and service\_type against anti-spam thresholds.

A query may indicate that thresholds have not been exceeded. The D2 220 returns status of 'allow' to the SG 222. The SG 222 routes Deliver\_SM to the destination ESME 202. The ESME 202 returns Deliver\_SM\_Resp to the SG 222. The SG 222 returns to Deliver\_SM\_Resp to MC 224<sub>1</sub>-224<sub>x</sub>. The D2 220 sends Update to DUE Server 218 to update its anti-spam counters. The DUE Server 218 responds to D2 220 with Update\_Resp containing status.

Finally, with FIG. 13, we discuss the scenario where a MO message delivery occurs with the anti-spam check unsuccessful. The MC 224<sub>1</sub>-224<sub>x</sub> receives an SMDPP for MO teleservice for delivery beyond the wireless network. The MC 224<sub>1</sub>-224<sub>x</sub> sends Deliver\_SM including service\_type and source\_address parameters to the SG 222. The SG 222 checks service\_type parameter in Deliver\_SM. If service type has anti-spam check enabled, the SG 222 sends 'AS\_Check' message to the D2 220. Parameters include service\_type and source\_address (MDN). The D2 220 checks the MDN and service\_type against anti-spam thresholds. A query may indicate that thresholds have been exceeded. The D2 220 returns status of 'deny' to the SG 222. The SG 222 sends Deliver\_SG\_Resp with command\_status set to 'service denied' to the MC 224<sub>1</sub>-224<sub>x</sub>. The D2 220 sends an Update to DUE Server 218 to update its anti-spam counters. The DUE Server 218 responds to D2 220 with Update\_Resp containing status. The message flow shown in FIG. 13 also applies to Data\_SM PDU.

MO message processing logic 500 at the SG 222 is shown in FIG. 14. When the SG 222 receives a Deliver\_SM or Data\_SM PDU from an MC 224<sub>1</sub>-224<sub>x</sub>, it checks the bind state (504) of the sending MC 224<sub>1</sub>-224<sub>x</sub>. If the MC 224<sub>1</sub>-224<sub>x</sub> is not bound, the SG 222 rejects the message (506) and indicates that the ESME 202 is not bound in the response to the originating MC (526). An appropriate error code is included in the response PDU. The SG 222 then waits for the next MO message (528).

When the SG 222 receives a Deliver\_SM or Data\_SM PDU 502 from an MC 224<sub>1</sub>-224<sub>x</sub> with a service\_type configured to require an anti-spam check (508), the SG 222 sends an AS\_Check request to the D2 (510). For MO service types, the AS\_Check query is populated with destination\_address, service\_type, and source\_address parameters. If the AS\_Check\_Resp has a value of deny (512), the SG 222 rejects the message (514) and responds to the MC (526) with a command\_status of Service Denied



in the Deliver\_SM\_Resp or Data\_SM\_Resp PDUs. The SG 222 waits for the next MO message (528).

If the MO message successfully completes bind check (504) and anti-spam check (512)(the anti-spam status is “allowed”), or if the anti-spam service is not enabled for the service type (508), the SG 222 invokes the routing method (516) for the service identified by the service\_type parameter. The SG 222 determines whether an ESME 202 is available for the service type (518). The SG 222 sends the Deliver\_SM or Data\_SM PDU to the ESME 202 identified by the routing method. The SG 222 receives the Deliver\_SM\_Resp or Data\_SM\_Resp PDU from the destination ESME 202 and subsequently sends it to the originating MC 224<sub>1</sub>-224<sub>x</sub> unaltered. The SG 222 responds to the MC 224<sub>1</sub>-224<sub>x</sub> with a command\_status of Service Type Not Available in the Deliver\_SM\_Resp or Data\_SM\_Resp PDUs if the SG 222 cannot route a message to an ESME 202 because all ESMEs 202 defined to receive the service\_type are unavailable (520).

The SG 222 logs all occurrences of when the Service Type Not Available command\_status is returned to an MC 224<sub>1</sub>-224<sub>x</sub> (MO service type not available). The minimum information provided includes time, service type that could not be routed, and source MC 224<sub>1</sub>-224<sub>x</sub>. Other information may be provided. The SG 222 may issue an alarm (520) when a MO Service Type is not available. The minimum information provided includes the time, Service Type, and indication that MO Service Type is unavailable. Other information may be provided. The SG 222 logs when a MO Service Type becomes unavailable. The minimum information provided includes time, Service Type, and indication that MO Service Type is unavailable, plus other optional information.

The SG 222 issues a clearing alarm when an MO Service Type becomes available. The minimum information provided includes time, Service Type, and indication that MO

Service Type is available. Additional information may also be provided. The SG 222 logs when a MO Service Type becomes available. The minimum information provided includes time, Service Type, and indication that MO Service Type is available, plus other information may also be provided.

5           If the response from the ESME 202 indicates that it is available for the service type (518), the message is routed to the destination ESME (522) and a response is sent to the SG 222 from the ESME 202 indicating that the message was received (524, 526). Finally, the SG 222 waits for the next MO message (528). The SG 222 responds to the MC 224<sub>1</sub>-224<sub>x</sub> with a command\_status of Invalid Service Type in the Deliver\_SM\_Resp  
10 or Data\_SM\_Resp PDUs if the service\_type parameter contains an unrecognized or undefined service type value.

We now turn to the cancel operation according to the present invention. This is illustrated in FIG. 15. A cancel operation is used by an ESME 202 to cancel one or more previously submitted messages. A specific message can be canceled based on the  
15 message\_id and service\_type parameters. A set of messages can be canceled using the service\_type and destination\_address parameters. FIG. 15 illustrates the cancel message procedure between an ESME 202, the SG 222, and the MC 224<sub>1</sub>-224<sub>x</sub>.

To cancel a single message, the ESME 202 sends a Cancel\_SM to the SG 222. The message\_id parameter is populated with the message\_id returned in the original  
20 Submit\_SM, Data\_SM, or Submit\_Multi message. The SG 222 routes the Cancel\_SM to the MC 224<sub>1</sub>-224<sub>x</sub> that received the original message. The message\_id parameter uniquely identifies the MC 224<sub>1</sub>-224<sub>x</sub> that originally received the message. Note that not all routing methods support canceling messages. If the MC 224<sub>1</sub>-224<sub>x</sub> that originally received the message is not available, then the SG 222 returns a new error code 'Service  
25 type not available' in command\_status. The destination MC 224<sub>1</sub>-224<sub>x</sub> replies with Cancel\_SM\_Resp. The SG 222 sends Cancel\_SM\_Resp to the ESME 202.

To cancel all messages previously submitted for a specific destination address and service type, the ESME 202 sends a Cancel\_SM to the SG 222. The message\_id parameter is set to null; the service\_type is set to the service type of the messages to be cancelled. The destination\_addr is set to the destination addresses of the messages to be canceled. The SG 222 routes the Cancel\_SM to the MC 224<sub>1</sub>-224<sub>x</sub> that received the original messages. Routing is based on service\_type and destination\_addr. If the MC 224<sub>1</sub>-224<sub>x</sub> that originally received message is not available, then the SG 222 returns a new error code 'Service type not available' in command\_status. The destination MC 224<sub>1</sub>-224<sub>x</sub> replies with Cancel\_SM\_Resp. The SG 222 sends a Cancel\_SM\_Resp signal to the ESME 202.

Next, the replace operation is described with reference to FIG. 16. The replace operation is used by an ESME 202 to replace a previously submitted message that is pending delivery. An ESME 202 sends a Replace\_SM signal to the SG 222. The message\_id parameter is populated with the message\_id returned in the original Submit\_SM, Submit\_Multi message. The ESME 202 retains the message\_id returned in the original message. The SG 222 routes the Replace\_SM to the MC 224<sub>1</sub>-224<sub>x</sub> that received the original message. The message\_id parameter uniquely identifies the MC 224<sub>1</sub>-224<sub>x</sub> that originally received the message. If the MC 224<sub>1</sub>-224<sub>x</sub> that originally received message is not available, then the SG 222 returns a new error code 'Service type not available' in command\_status. The destination MC 224<sub>1</sub>-224<sub>x</sub> replies with Replace\_SM\_Resp containing message status. The SG 222 sends Replace\_SM\_Resp to the ESME 202.

FIG. 17 shows an example of a check link status inquiry. In this case, the ESME 202 inquires regarding the link between the ESME 202 and the SG 222. The SG 222 may send Enquire\_Link to the MC 224<sub>1</sub>-224<sub>x</sub> to check the application level communications link between the SG 222 and the MC 224<sub>1</sub>-224<sub>x</sub>. The MC 224<sub>1</sub>-224<sub>x</sub> responds with

Enquire\_Link\_Resp. The ESME 202 may send Enquire\_Link to the SG 222 to check the application level communications link between the ESME 202 and the SG 222. the SG 222 responds with Enquire\_Link\_Resp.

FIG. 18 illustrates the alert notification protocol used by the MC to notify an  
5 ESME 202 that an MS 236 has become available. The ESME 202 sends a Data\_SM signal to the SG 222 with set\_dpof set for delivery failure request. The SG 222 routes Data\_SM to destination MC 224<sub>1</sub>-224<sub>x</sub>. The MC 224<sub>1</sub>-224<sub>x</sub> attempts message delivery. If the MS 236 is not available, the MC 224<sub>1</sub>-224<sub>x</sub> returns Data\_SM\_Resp to the SG 222 indicating the dpof\_status. The SG 222 sends Data\_SM\_Resp to the ESME 202  
10 indicating the dpof\_status. At some later time, the MC 224<sub>1</sub>-224<sub>x</sub> successfully delivers the message to the MC 224<sub>1</sub>-224<sub>x</sub>. The MC 224<sub>1</sub>-224<sub>x</sub> sends Alert\_Notification to the SG 222 indicating dpof\_status. The SG 222 routes Alert\_Notification to the ESME 202 using the esme\_addr parameter.

Over-the-air activation is also available with the introduction of the SG 222 into  
15 the messaging complex 216. FIG. 19 illustrates an example activation message flow according to the present invention. An OTAF sends a Submit\_SM signal to the SG 222. The MS 236 number assignment module (NAM) data is contained in the short\_message parameter. The NAM data associates the mobile identification number (MIN) with the electronic serial number (ESN). The destination\_address parameter contains activation  
20 MIN. For an Initial Over the Air Activation (IOAA), the SG 222 extracts the electronic serial number (ESN) from the MS NAM data in the short\_message parameter. The IOAA process refers to the first time a phone is activated over the air. During IOAA, parameters are downloaded to the phone allowing it to operate in the wireless network. For example, the phone receives its MDN (phone number) along with other parameters  
25 required for it to operate in the network.

Routing is based on odd or even ESN value. The SG 222 routes Submit\_SM to the destination MC 224<sub>1</sub>-224<sub>x</sub> based on the ESN value. If an MC 224<sub>1</sub>-224<sub>x</sub> is not available, the SG 222 returns 'service not available' in command\_status. The MC 224<sub>1</sub>-224<sub>x</sub> responds with Submit\_SM\_Resp with a unique message\_id. The message\_id can subsequently be used to query or cancel request from the OTAF. The SG 222 sends a Submit\_SM\_Resp signal to the OTAF. The MS 236 registers with activation MIN at the MC 224<sub>1</sub>-224<sub>x</sub>. A REGNOT signal is routed to the MC 224<sub>1</sub>-224<sub>x</sub> by STP based on odd or even ESN value. Then IOAA can occur using existing procedures.

For the operation of reprogramming over-the-air-activation (ROAA), the OTAF sends a Submit\_SM signal to the SG 222. The MS NAM data is contained in the short\_message parameter. The destination\_address parameter contains the MIN of the MS 236. Then the steps from the SG 222 extracting the ESN through the SG 222 sending the Submit\_SM\_Resp to OTAF signal are the same as the IOAA above.

The MC 224<sub>1</sub>-224<sub>x</sub> sends a SMSGEQ signal to the HLR 226. The HLR 226 responds with a SMSGEQ signal containing the SMS\_Address. If the MS 236 is not registered, the standard delivery pending and SMSNOT procedures apply. Then, ROAA can be accomplished using existing procedures.

At the MC 224<sub>1</sub>-224<sub>x</sub> providing OTAP, RIP is set to 'replace' globally. Any pending activation (IOAA or ROAA) for a specific destination\_address is replaced regardless of the RIP parameter in Submit\_SM. The SG 222 must route IOAA and ROAA requests for the same MS 236 to the same MC 224<sub>1</sub>-224<sub>x</sub> so pending messages can be replaced if present. The RIP is based on destination\_address. The Destination address is the activation MIN for IOAA and MIN for ROAA. Therefore, the SG 222 routing is based on ESN not MIN.

The SG 222 will have certain functions that it performs. These include security, anti-spam and flow control, and ESME – SG flow control. Regarding security issues, the

ESMEs 202 will communicate with the SG 222 using dedicated network connections.

The SG 222 is not connected to the Internet. The SG 222 implementation and

communication with ESMEs 202 must meet established security requirements. The

ESME 202 must be authorized to bind to the SG 222. Parameters for binding include

- 5 System ID, specific socket, and password. The ESME 202 must be authorized to request delivery of a specific service type. The ESME 202 must be authorized for each service type it is allowed to delivery. An ESME 202 may be authorized to deliver more than one service type. If the ESME 202 requests delivery of a service type for which it is not authorized, the request will be rejected. Encryption of messages between ESME
- 10 202 and SG 222 should not be required.

Having discussed the various functions of the SG 222, we now turn to FIG. 20, wherein example hardware requirements for the SG 222 are disclosed. The main

components of the SG 222 include at least one switch and at least one router. The

ESMEs 202 transmit messages through an IP network 250 to the SMPP gateway 222.

- 15 The SMPP gateway 222 comprises at least two routing servers, such as the Sun Microsystems Netra T 1400 Dual 440 MHz processor servers with 1GB memory and two 18 GB disks. The SG 222 is scalable from 2 to n routing nodes  $264_1 - 264_n$ . Other more current computer servers may also be used and are contemplated as within the scope of the invention. Other features such as slots for removable media devices and
- 20 other standard equipment are well known to those of skill in the art.

The servers control at least one and preferably two Cisco Local Director Routers

252, 254 as switches. Preferably, TCP/IP is the networking protocol to provide

communication across the diverse networks. Each switch 252, 254 preferably contains a

primary 256, 260 and a secondary 258, 262 component, respectively, for controlling the

- 25 destination of each message received from the IP network 250. The destination of each message from the primary 256, 260 or secondary 258, 262 components of the switches

252, 254 is a first routing node 264<sub>1</sub> or a second routing node 264<sub>2</sub>, up to "n" routing nodes. These routers are preferably Cisco Local Director Routers comprising LocalDirector 420, a four port 10/100 Ethernet card in a rack-mounted arrangement. The routers 264<sub>1</sub>, 264<sub>2</sub> route the messages to the appropriate message center 224<sub>1</sub>, 224<sub>2</sub>, or 224<sub>x</sub>. While specific hardware components are mentioned as preferable, this is not meant to limit the general components to any type of router, computer server, or switch that performs the functions disclosed herein for the SG 222.

Although the above description may contain specific details, they should not be construed as limiting the claims in any way. Other configurations of the described embodiments of the invention are part of the scope of this invention. For example, the above description discusses messages being passed between an ESME and a wireless device. However, the SG may be modified to route messages between wireless carriers. Thus, messages may be passed from a subscriber of one wireless carrier to a subscriber of another carrier for both MO and MT messages. Accordingly, the appended claims and their legal equivalents should only define the invention, rather than any specific examples given.